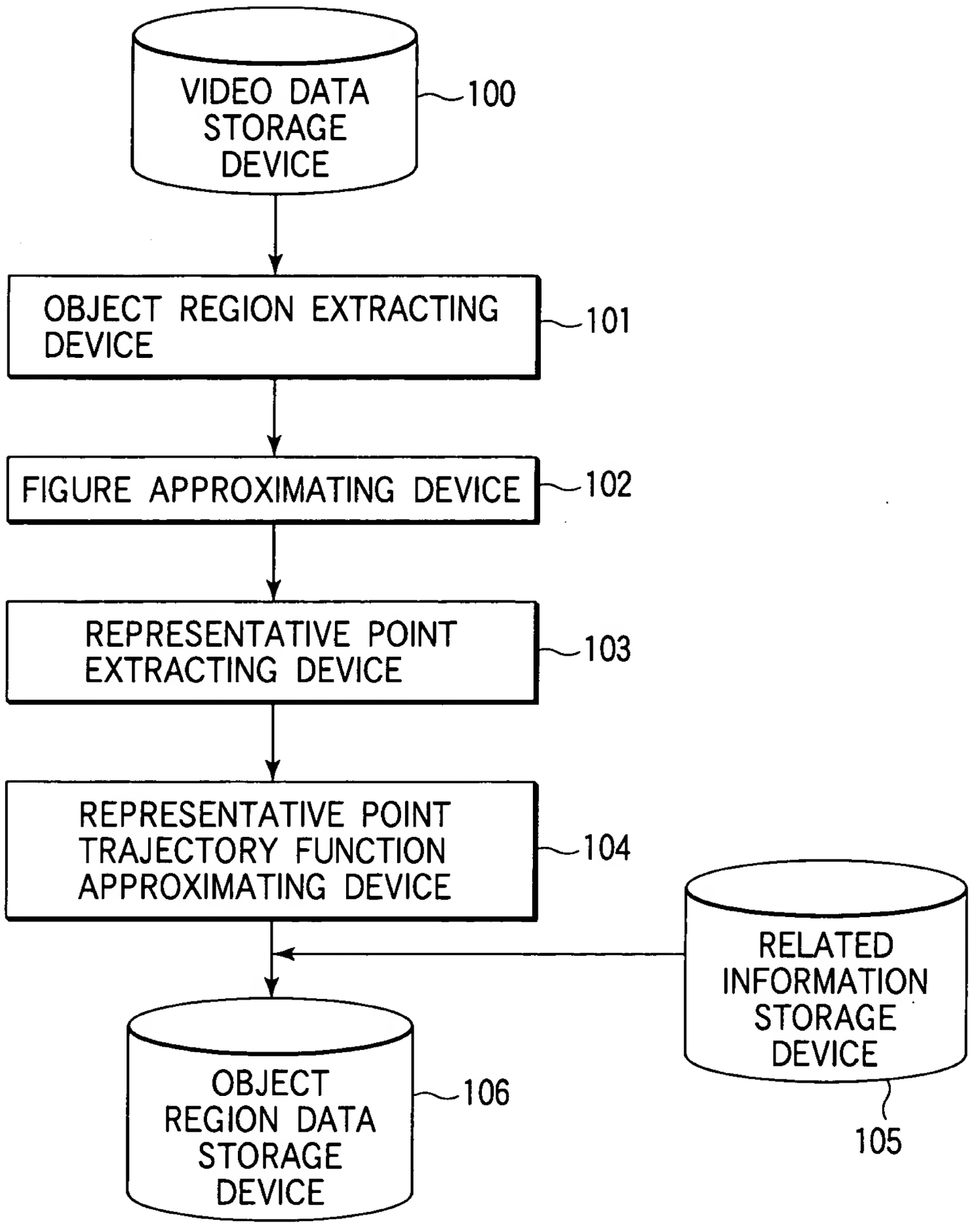

VIDEO DATA STORAGE DEVICE
100
OBJECT REGION EXTRACTING DEVICE
101
FIGURE APPROXIMATING DEVICE
102
REPRESENTATIVE POINT EXTRACTING DEVICE
103
REPRESENTATIVE POINT TRAJECTORY FUNCTION APPROXIMATING DEVICE
104
RELATED INFORMATION STORAGE DEVICE
105
OBJECT REGION DATA STORAGE DEVICE
106

FIG. 1

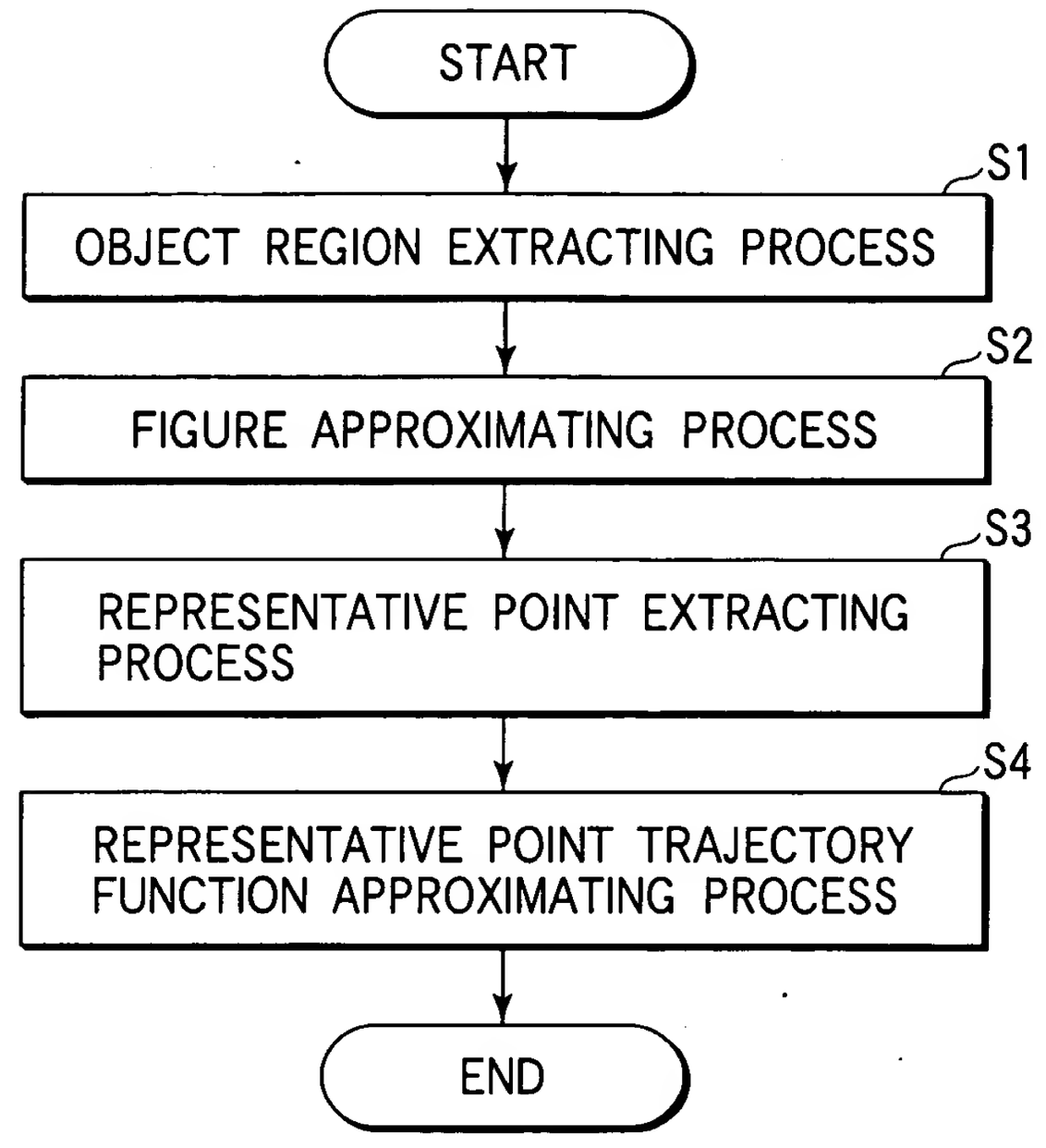


FIG. 2

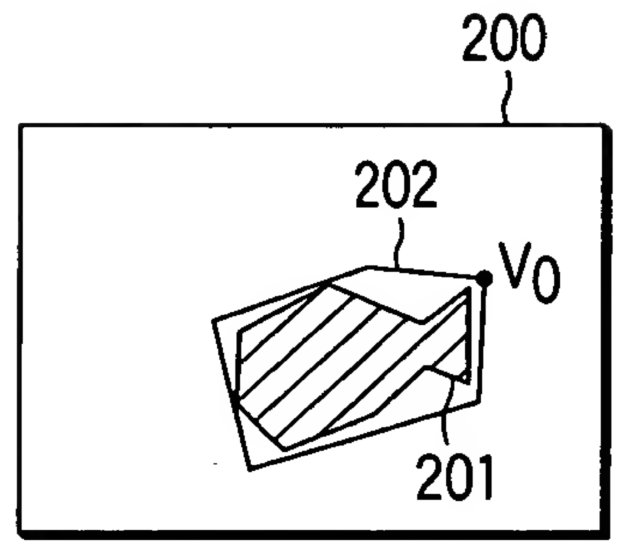


FIG. 3A

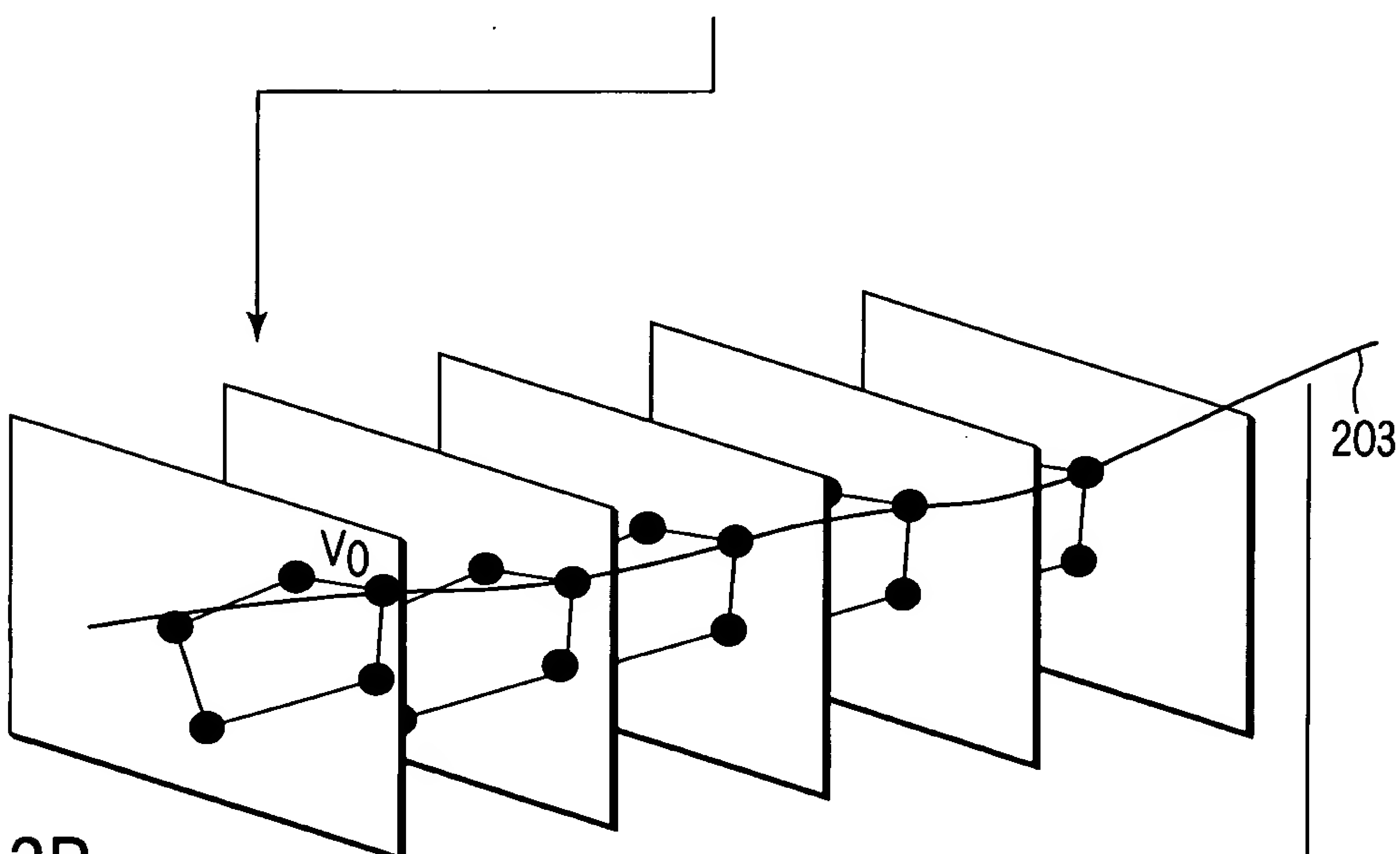


FIG. 3B

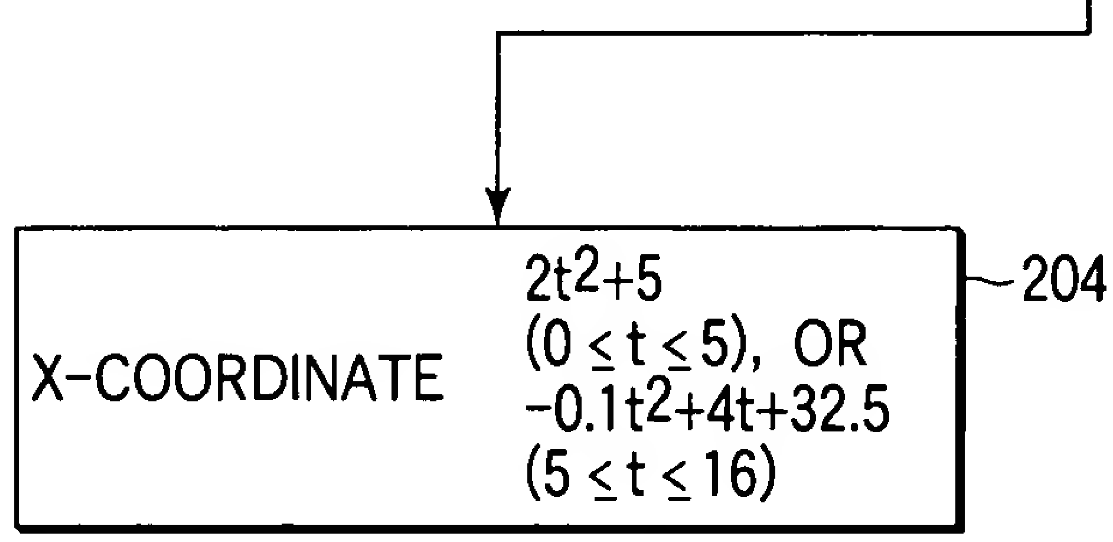


FIG. 3C

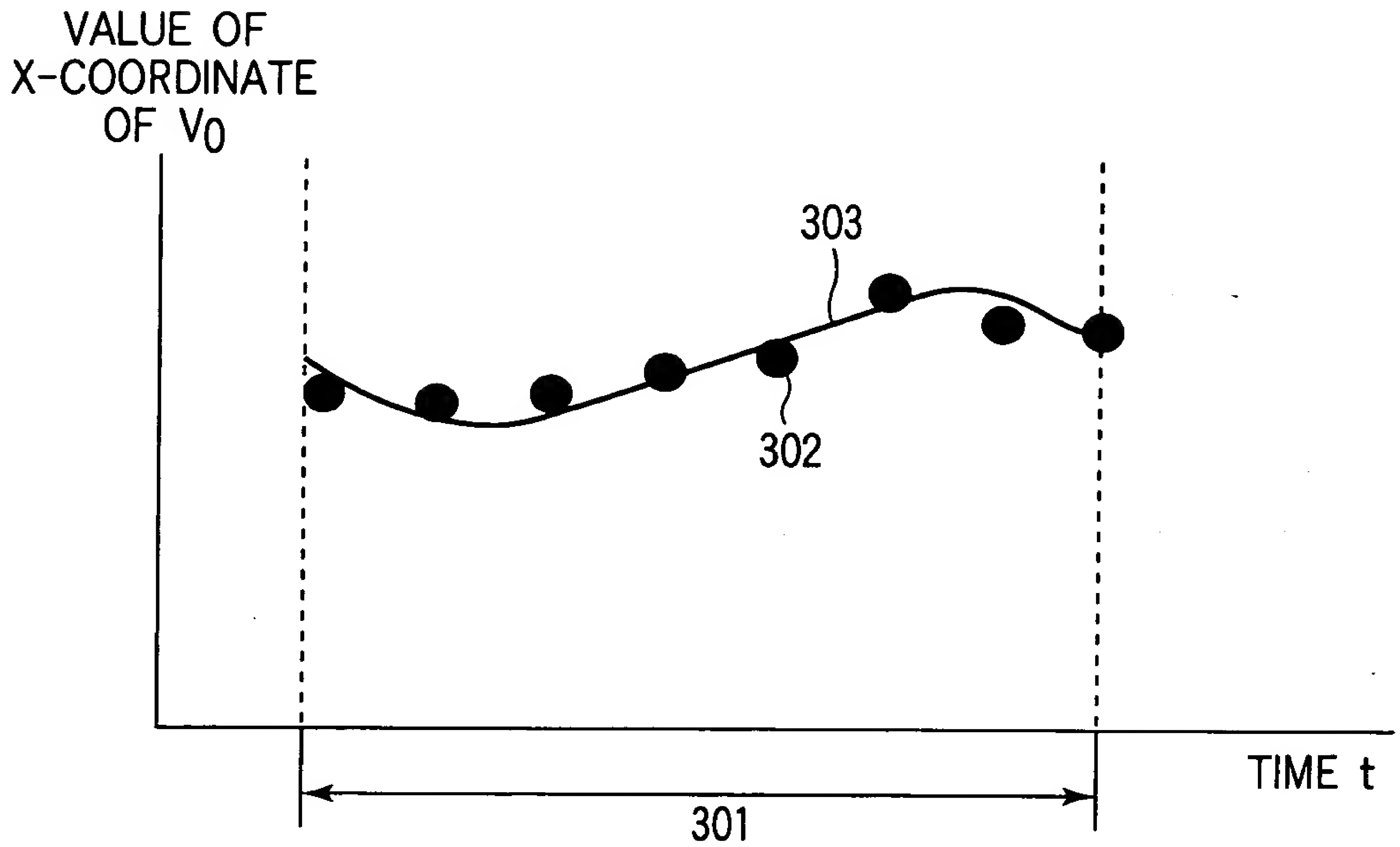


FIG. 4

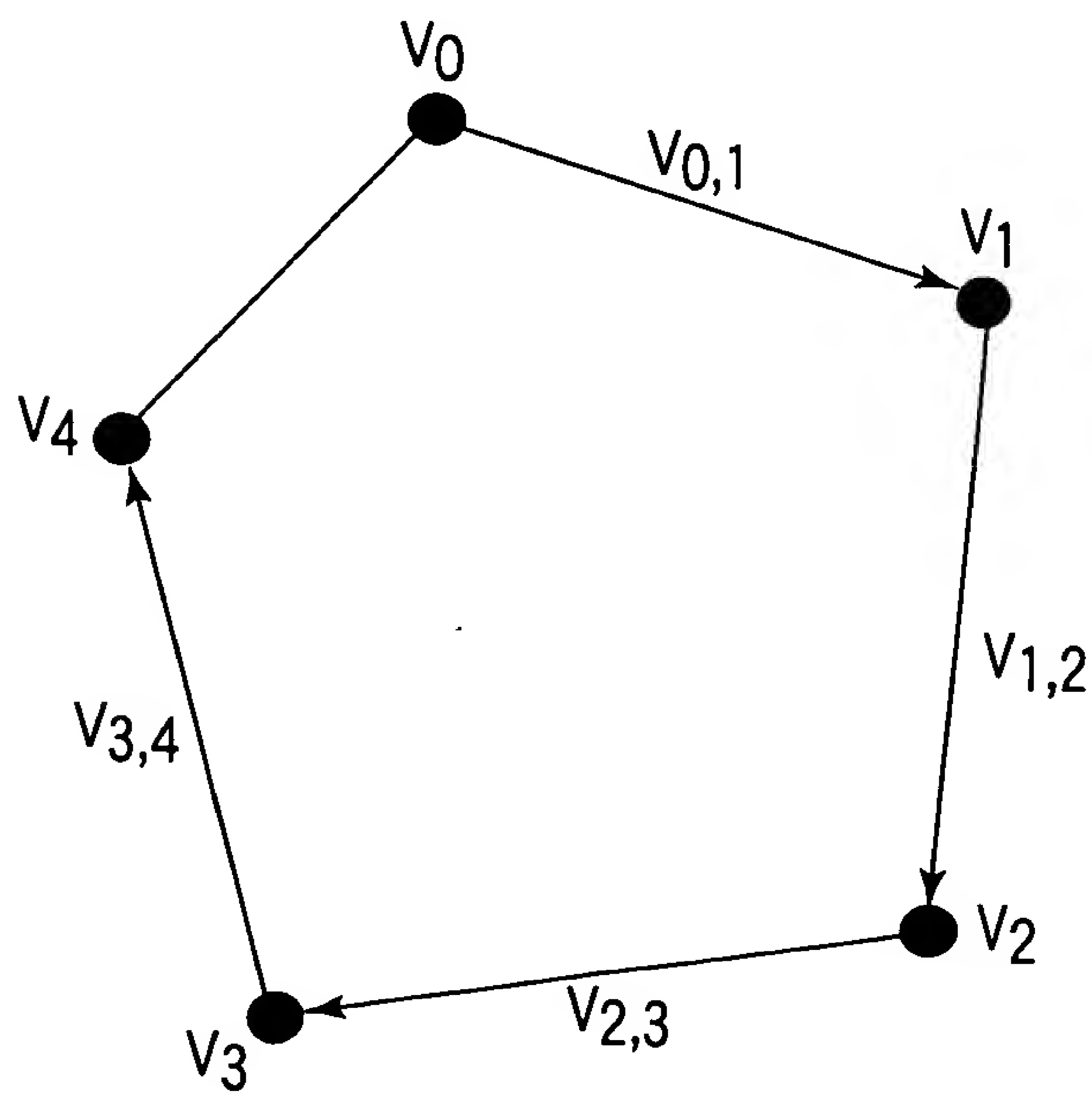


FIG. 5

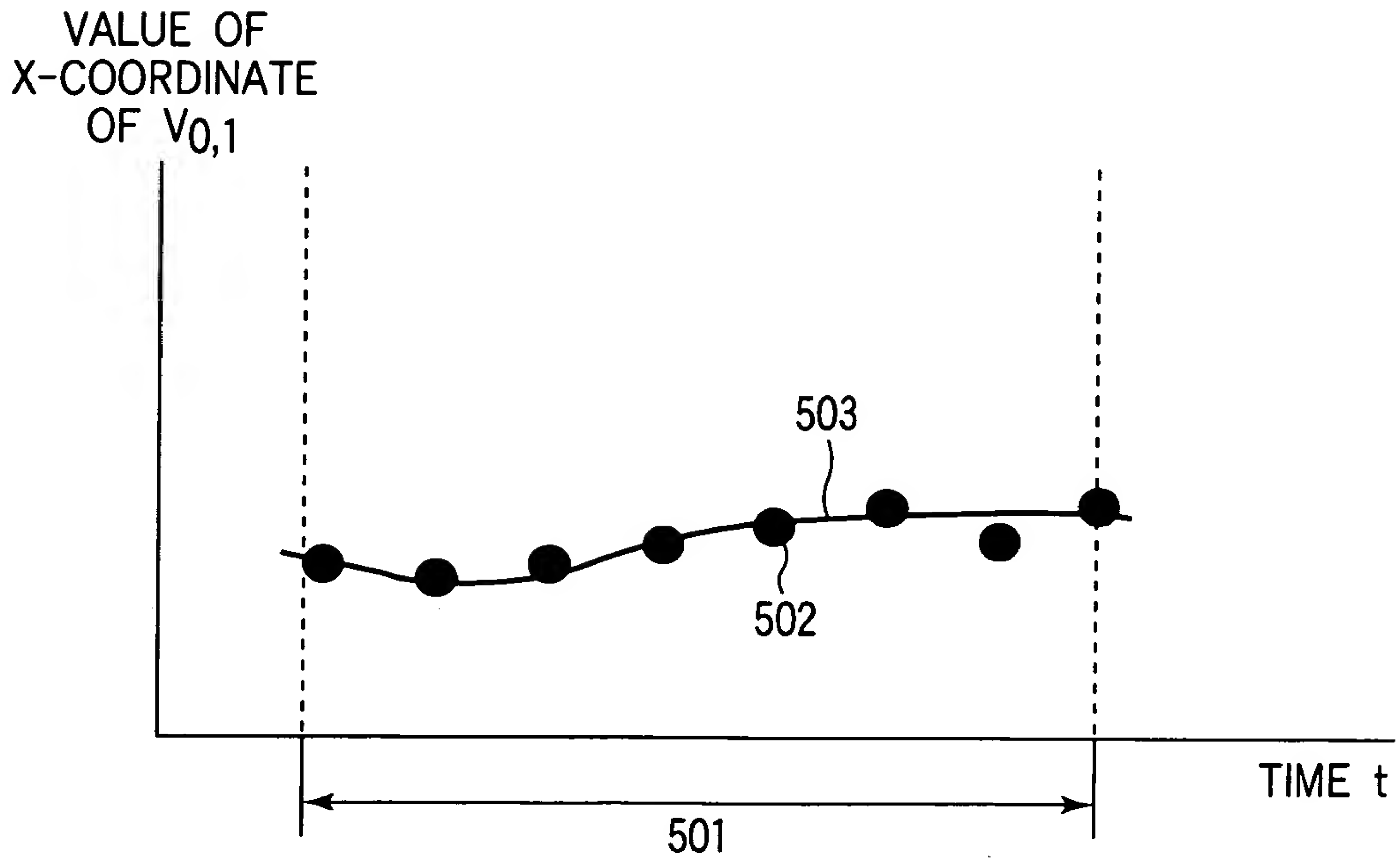


FIG. 6

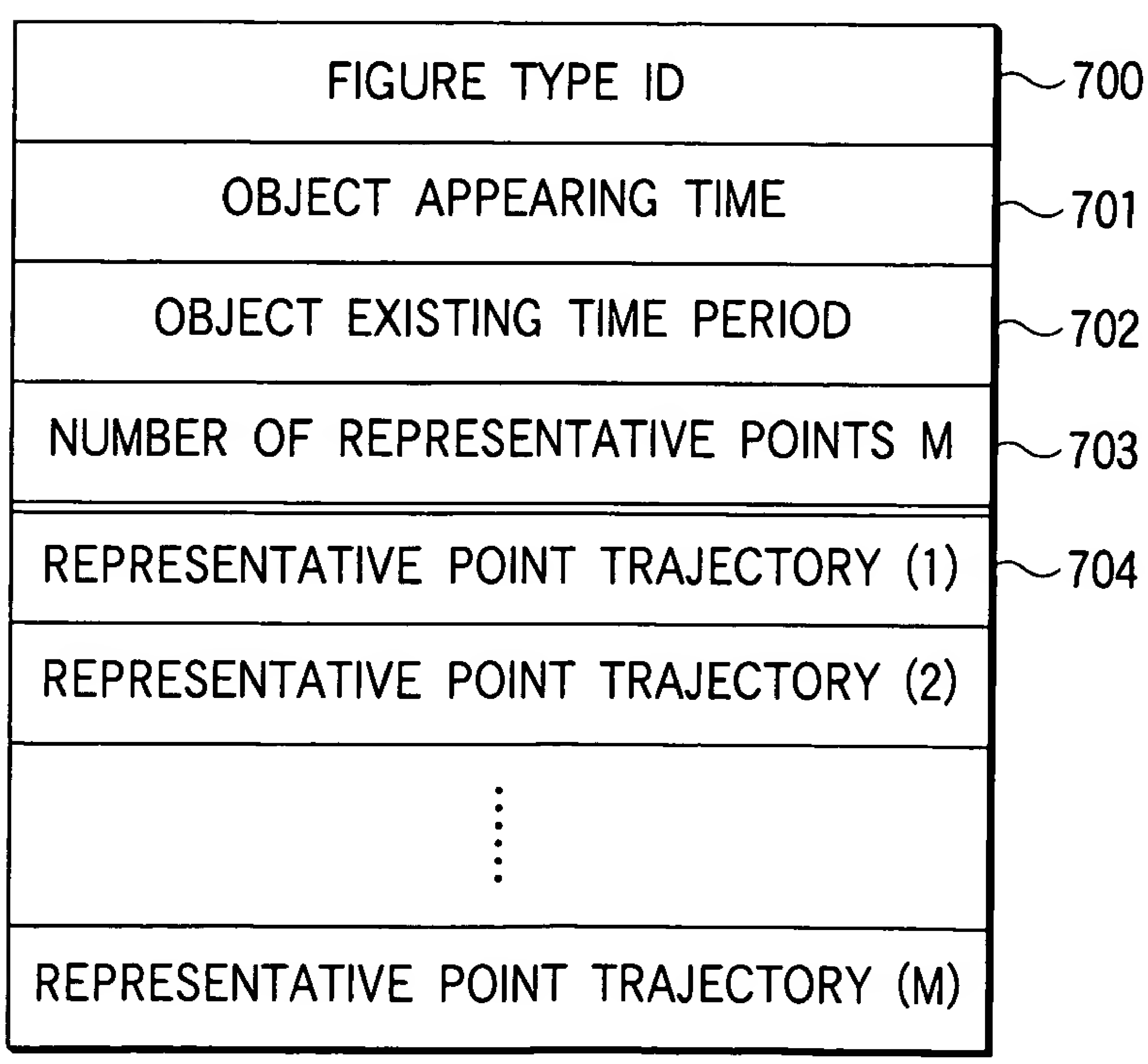


FIG. 8

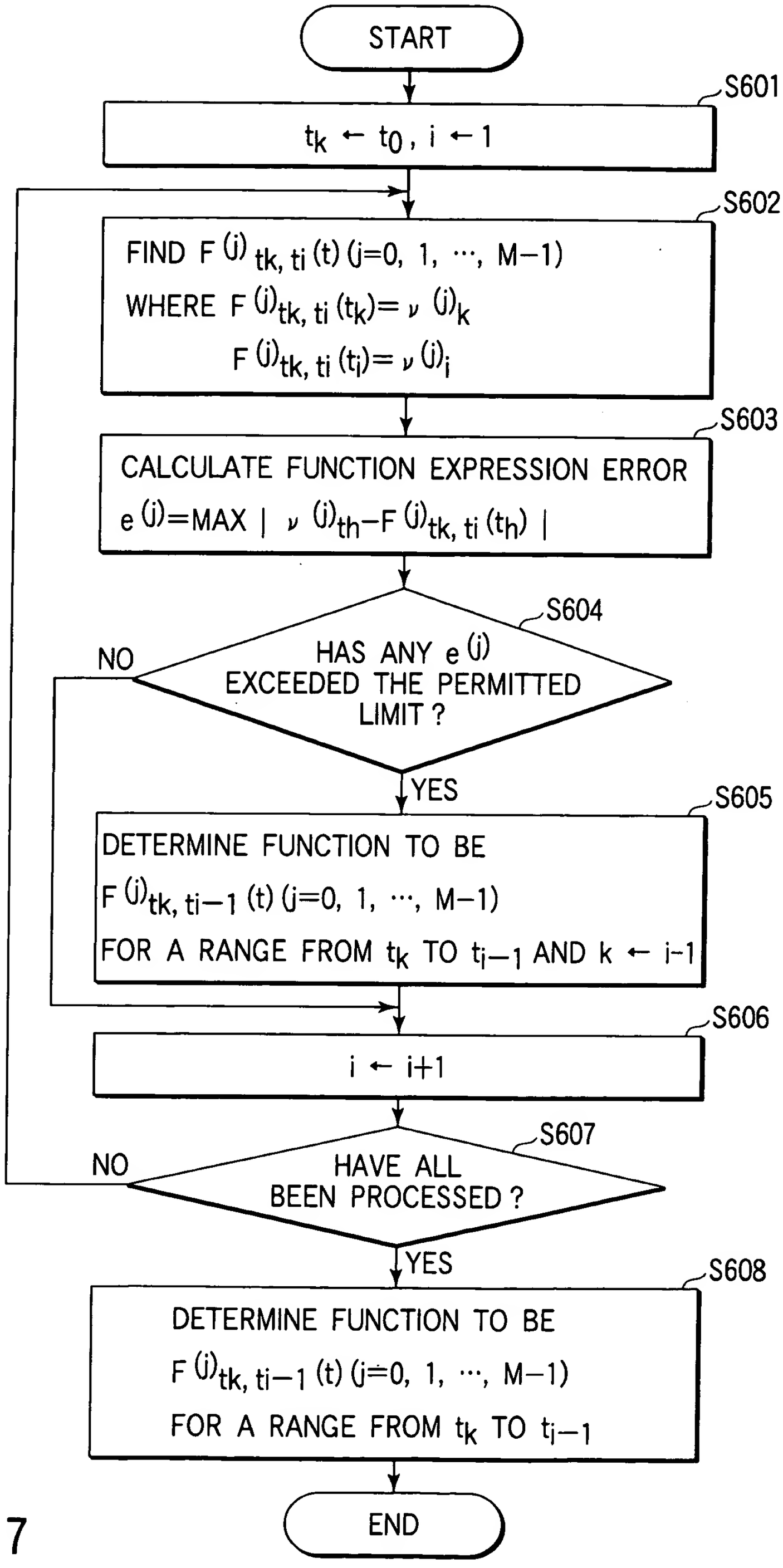

START
S601
$t_k \leftarrow t_0$, $i \leftarrow 1$
S602
FIND $F^{(j)}_{tk, ti}(t)$ (j=0, 1, ···, M−1)
WHERE $F^{(j)}_{tk, ti}(t_k) = \nu^{(j)}_k$
$F^{(j)}_{tk, ti}(t_i) = \nu^{(j)}_i$
S603
CALCULATE FUNCTION EXPRESSION ERROR
$e^{(j)} = MAX \mid \nu^{(j)}_{th} - F^{(j)}_{tk, ti}(t_h) \mid$
S604
HAS ANY $e^{(j)}$ EXCEEDED THE PERMITTED LIMIT ?
NO
YES
S605
DETERMINE FUNCTION TO BE
$F^{(j)}_{tk, ti-1}(t)$ (j=0, 1, ···, M−1)
FOR A RANGE FROM t_k TO t_{i-1} AND k ← i-1
S606
i ← i+1
S607
HAVE ALL BEEN PROCESSED ?
NO
YES
S608
DETERMINE FUNCTION TO BE
$F^{(j)}_{tk, ti-1}(t)$ (j=0, 1, ···, M−1)
FOR A RANGE FROM t_k TO t_{j-1}
END

FIG. 7

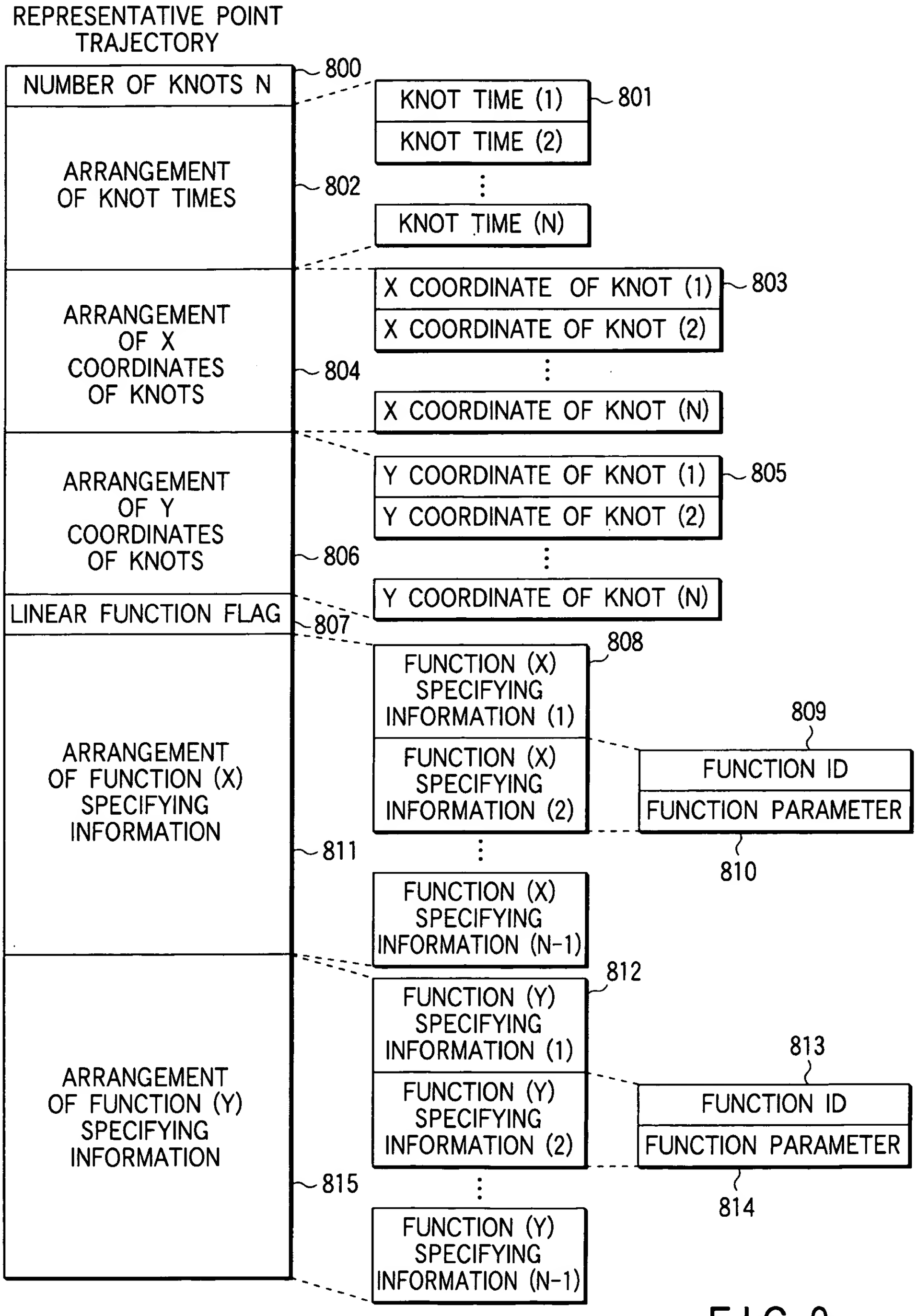


FIG. 9

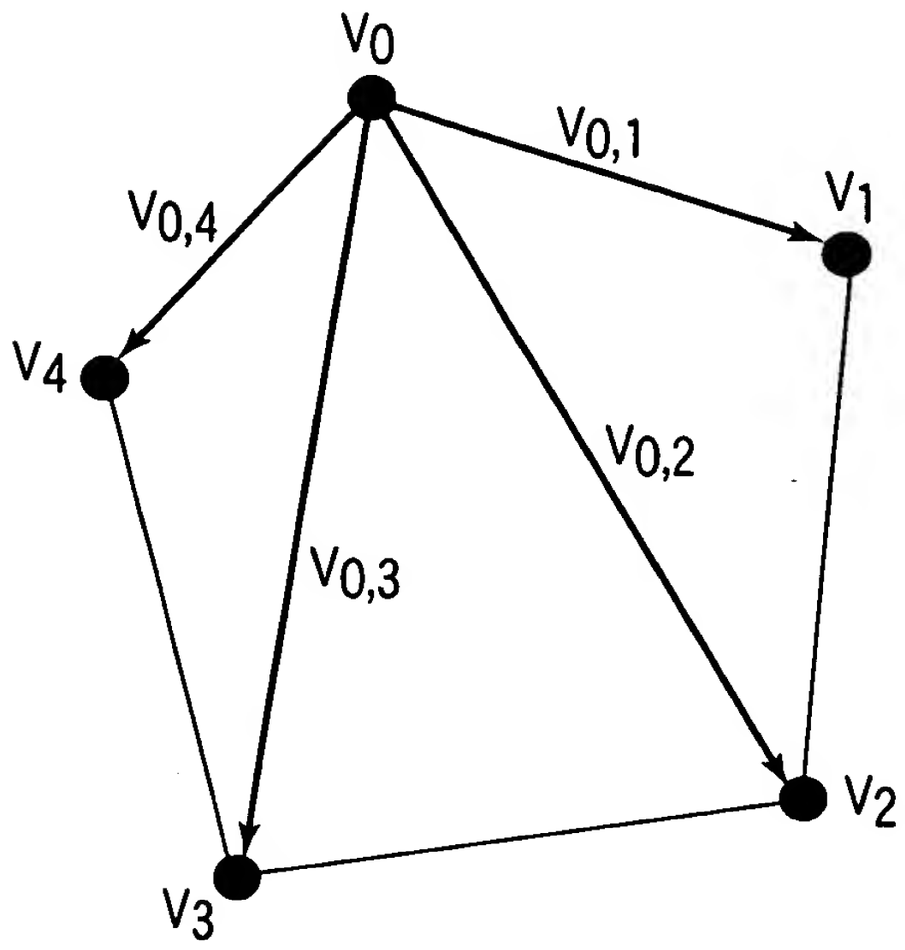


FIG. 10

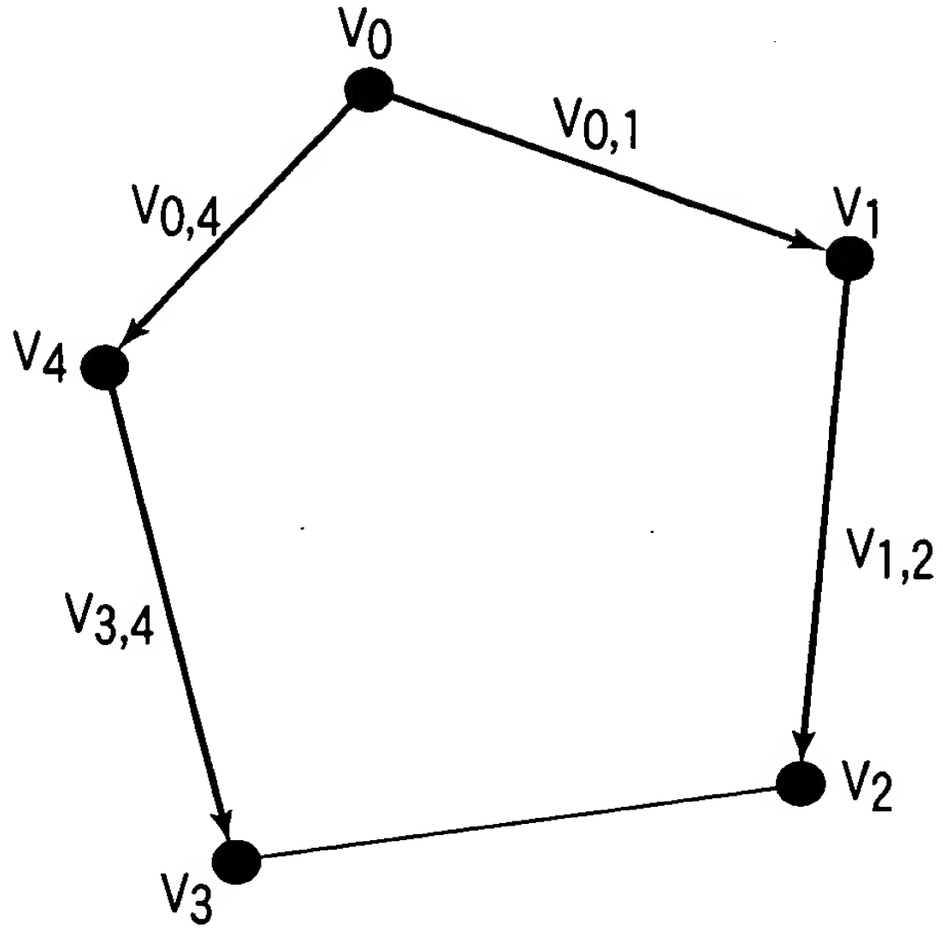


FIG. 11A

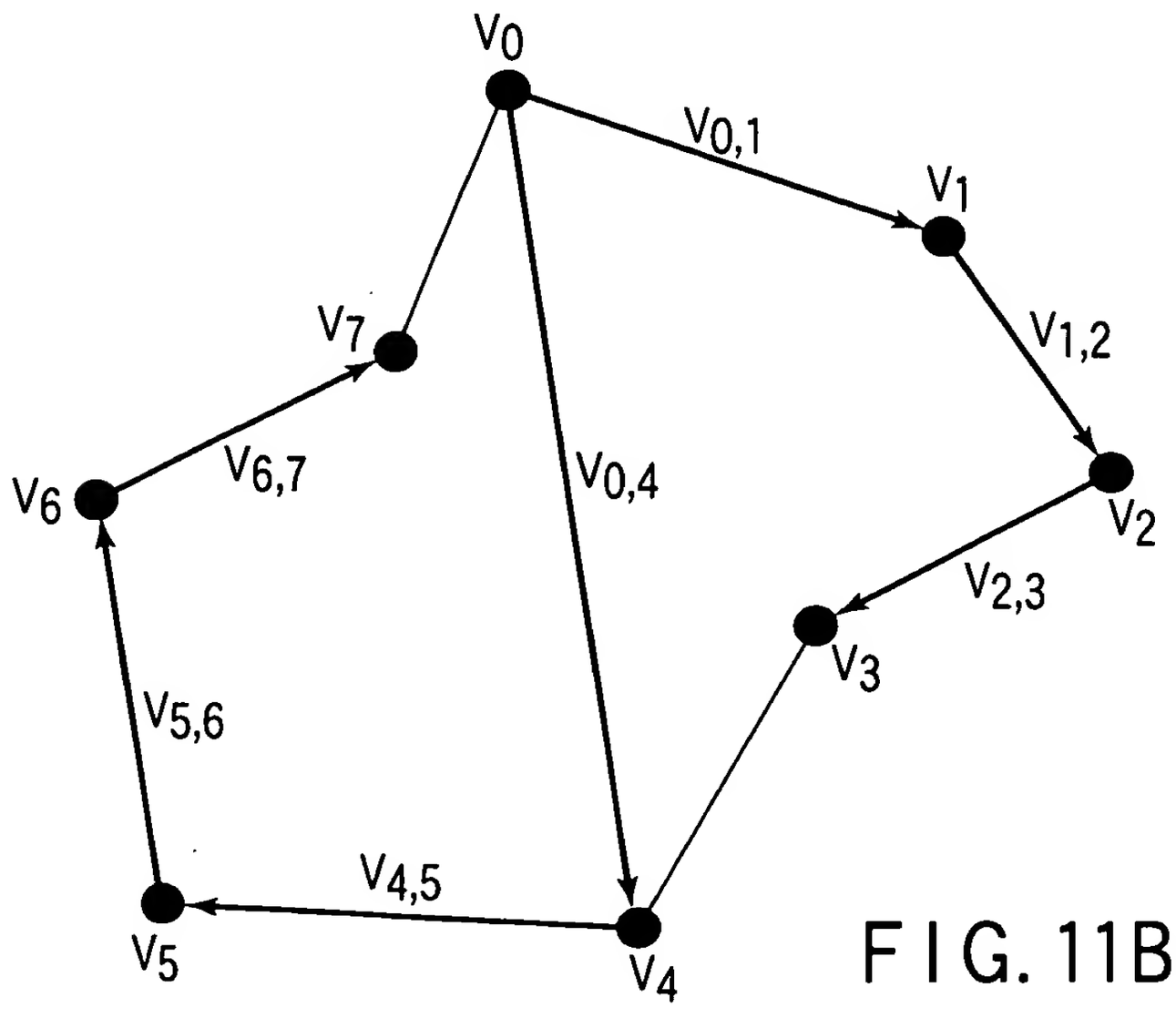


FIG. 11B

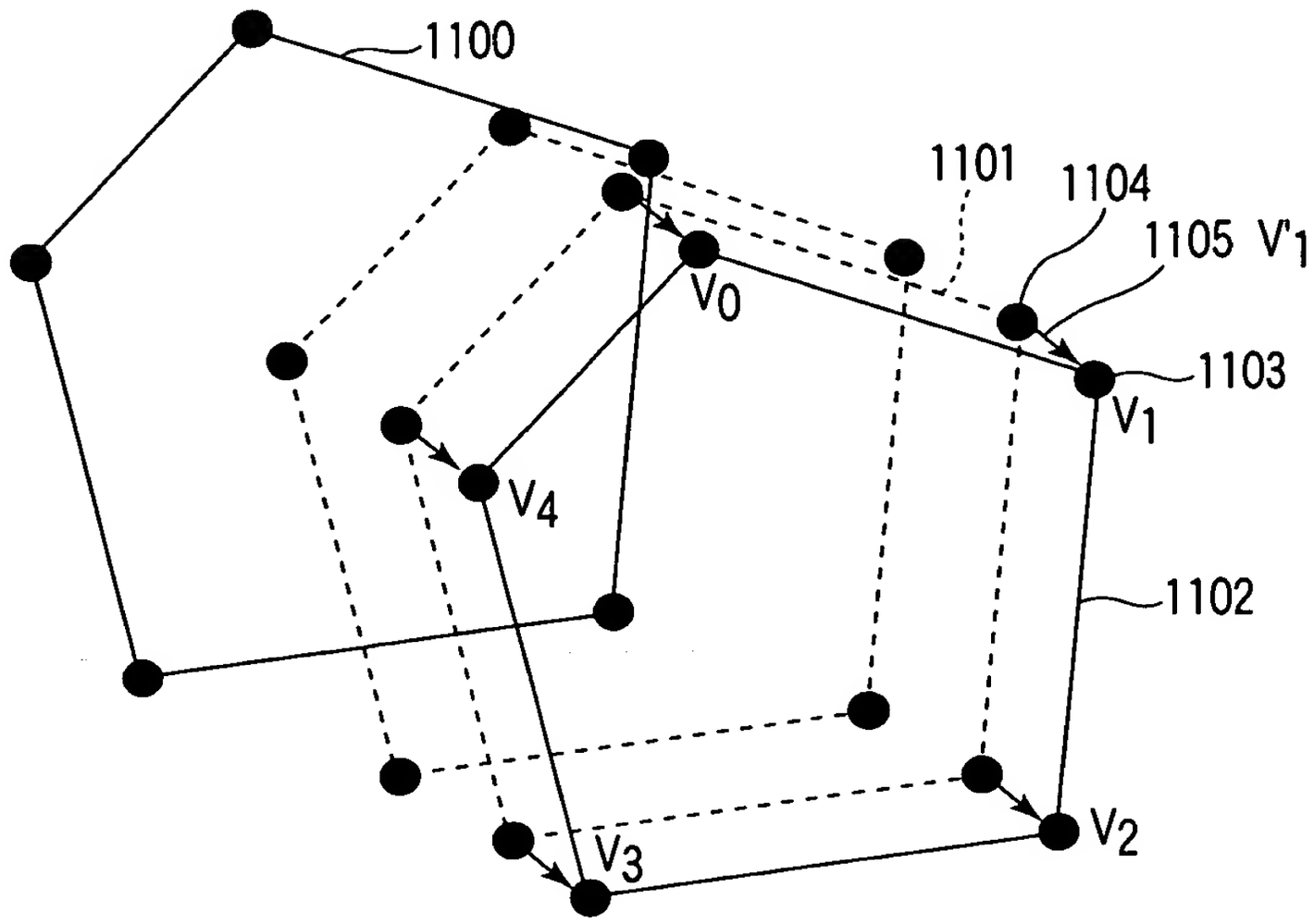


FIG. 12

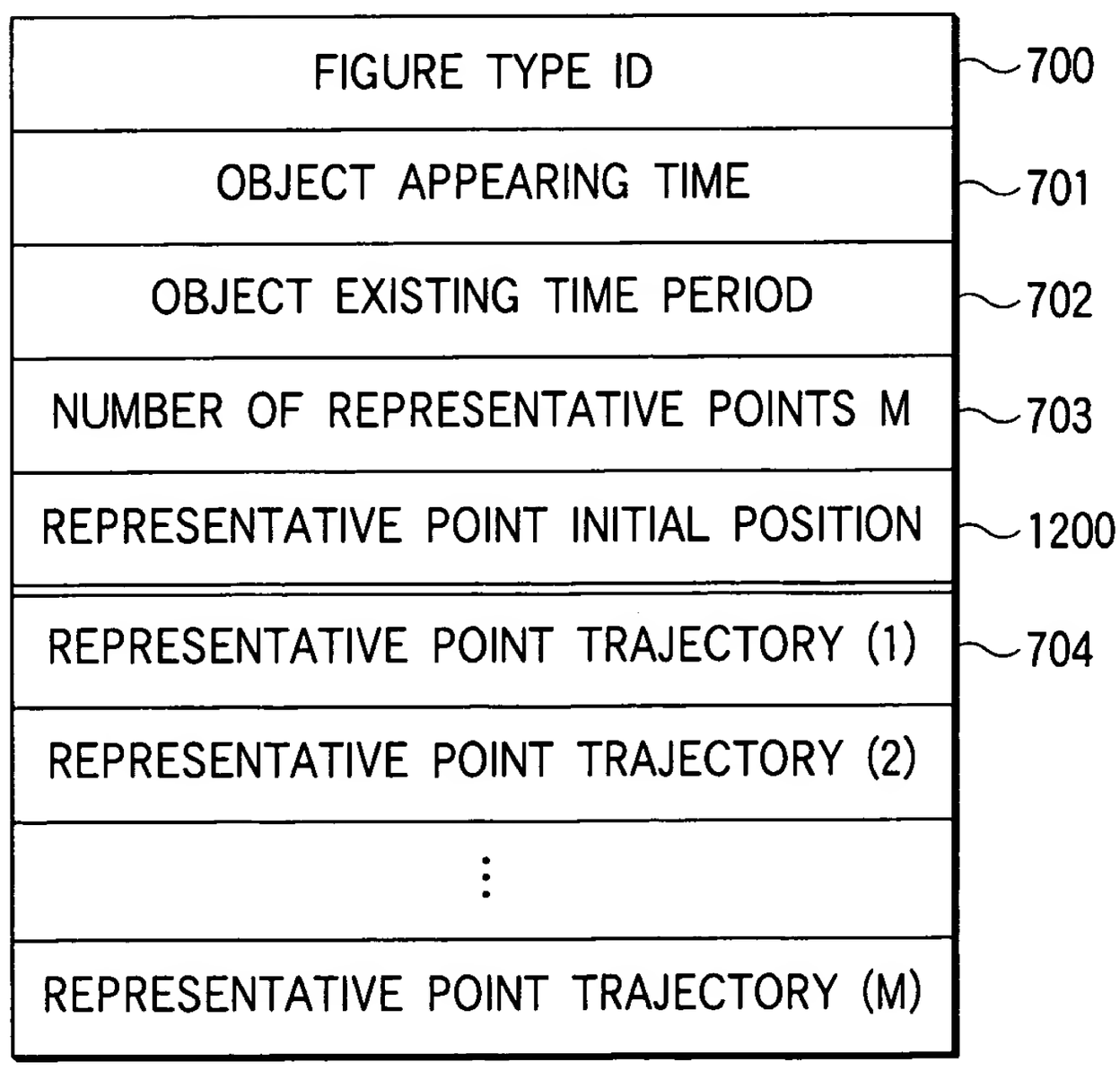


FIG. 13

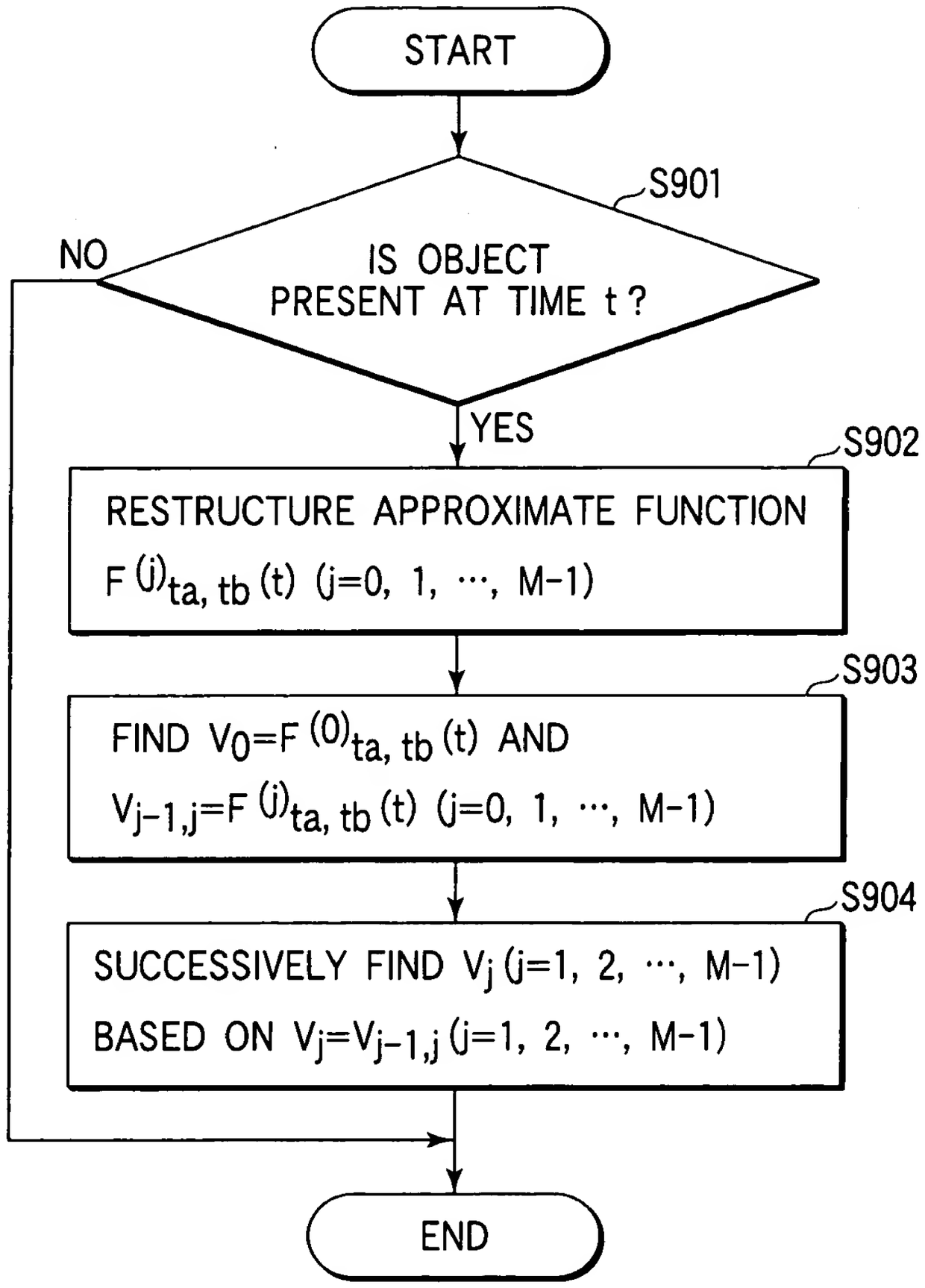

START
S901
IS OBJECT PRESENT AT TIME t ?
NO
YES
S902
RESTRUCTURE APPROXIMATE FUNCTION
$F^{(j)}_{ta, tb}(t)$ (j=0, 1, ···, M-1)
S903
FIND $V_0=F^{(0)}_{ta, tb}(t)$ AND
$V_{j-1,j}=F^{(j)}_{ta, tb}(t)$ (j=0, 1, ···, M-1)
S904
SUCCESSIVELY FIND V_j (j=1, 2, ···, M-1)
BASED ON $V_j=V_{j-1,j}$ (j=1, 2, ···, M-1)
END

FIG. 14

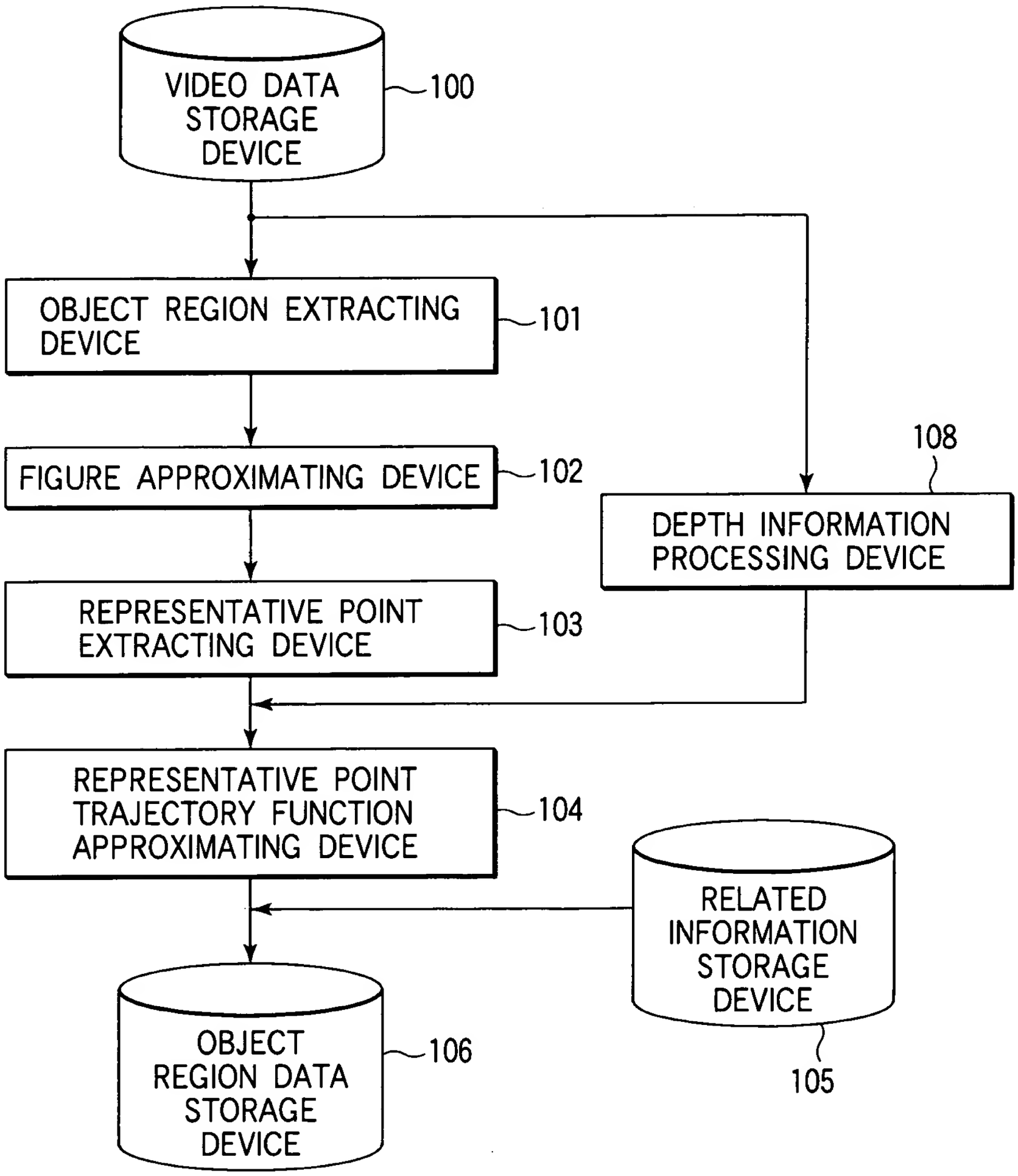

VIDEO DATA STORAGE DEVICE
100
OBJECT REGION EXTRACTING DEVICE
101
FIGURE APPROXIMATING DEVICE
102
REPRESENTATIVE POINT EXTRACTING DEVICE
103
REPRESENTATIVE POINT TRAJECTORY FUNCTION APPROXIMATING DEVICE
104
OBJECT REGION DATA STORAGE DEVICE
106
DEPTH INFORMATION PROCESSING DEVICE
108
RELATED INFORMATION STORAGE DEVICE
105

FIG. 15

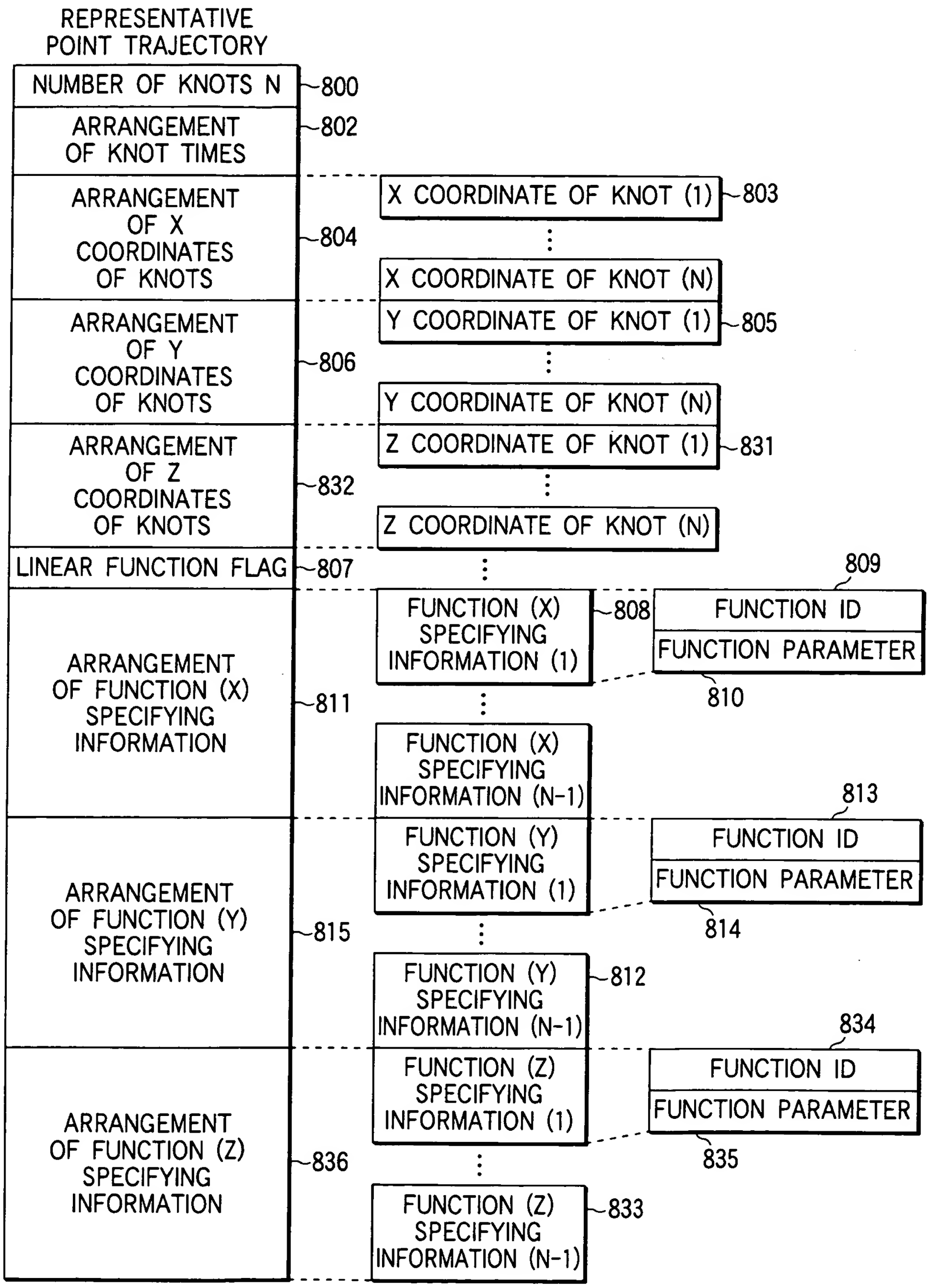

REPRESENTATIVE POINT TRAJECTORY
NUMBER OF KNOTS N
800
ARRANGEMENT OF KNOT TIMES
802
ARRANGEMENT OF X COORDINATES OF KNOTS
804
X COORDINATE OF KNOT (1)
803
X COORDINATE OF KNOT (N)
ARRANGEMENT OF Y COORDINATES OF KNOTS
806
Y COORDINATE OF KNOT (1)
805
Y COORDINATE OF KNOT (N)
ARRANGEMENT OF Z COORDINATES OF KNOTS
832
Z COORDINATE OF KNOT (1)
831
Z COORDINATE OF KNOT (N)
LINEAR FUNCTION FLAG
807
ARRANGEMENT OF FUNCTION (X) SPECIFYING INFORMATION
811
FUNCTION (X) SPECIFYING INFORMATION (1)
808
FUNCTION ID
FUNCTION PARAMETER
809
810
FUNCTION (X) SPECIFYING INFORMATION (N-1)
ARRANGEMENT OF FUNCTION (Y) SPECIFYING INFORMATION
815
FUNCTION (Y) SPECIFYING INFORMATION (1)
813
FUNCTION ID
FUNCTION PARAMETER
814
FUNCTION (Y) SPECIFYING INFORMATION (N-1)
812
ARRANGEMENT OF FUNCTION (Z) SPECIFYING INFORMATION
836
FUNCTION (Z) SPECIFYING INFORMATION (1)
834
FUNCTION ID
FUNCTION PARAMETER
835
FUNCTION (Z) SPECIFYING INFORMATION (N-1)
833

FIG. 16

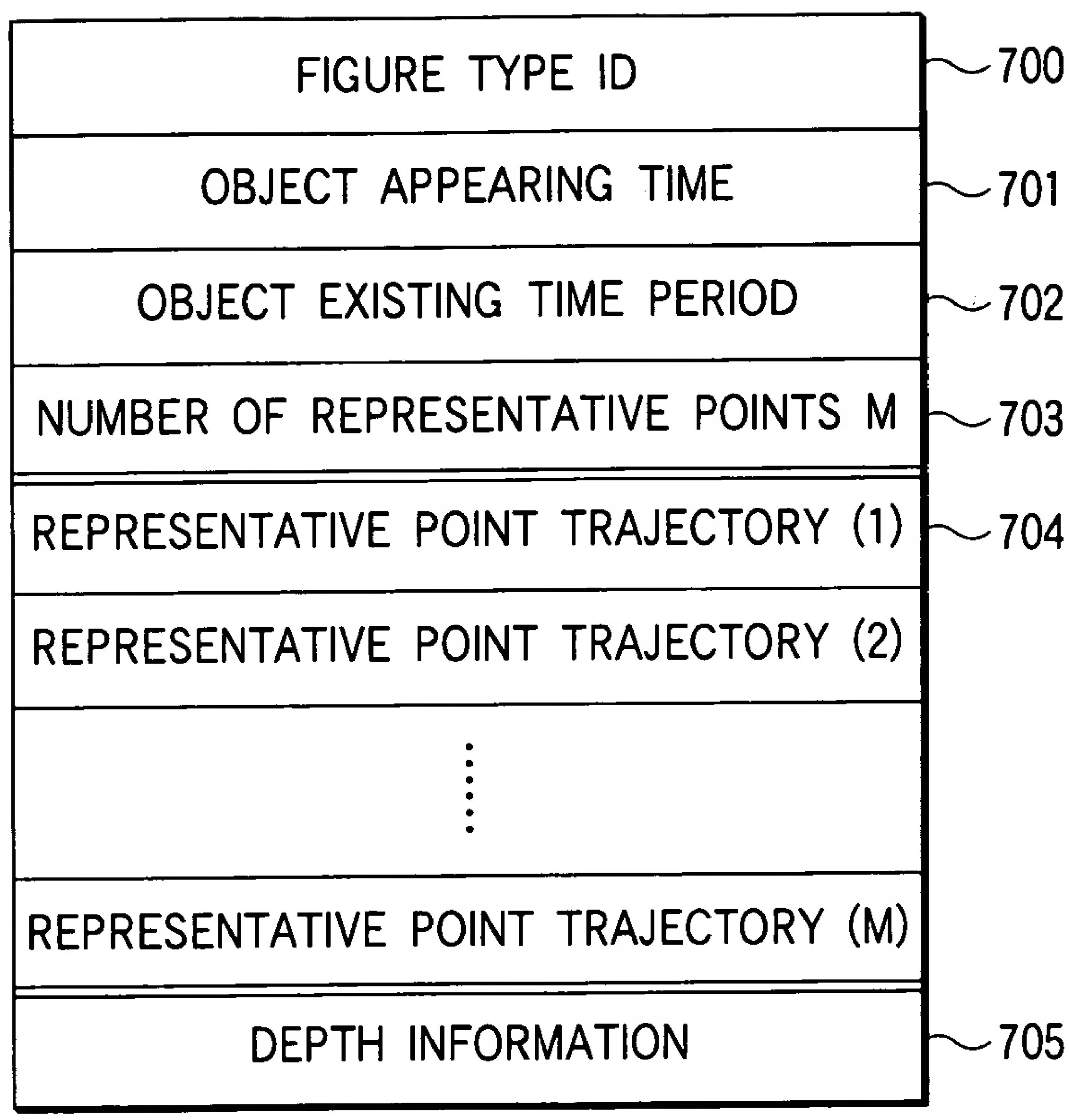


FIGURE TYPE ID
700
OBJECT APPEARING TIME
701
OBJECT EXISTING TIME PERIOD
702
NUMBER OF REPRESENTATIVE POINTS M
703
REPRESENTATIVE POINT TRAJECTORY (1)
704
REPRESENTATIVE POINT TRAJECTORY (2)
REPRESENTATIVE POINT TRAJECTORY (M)
DEPTH INFORMATION
705

FIG. 17

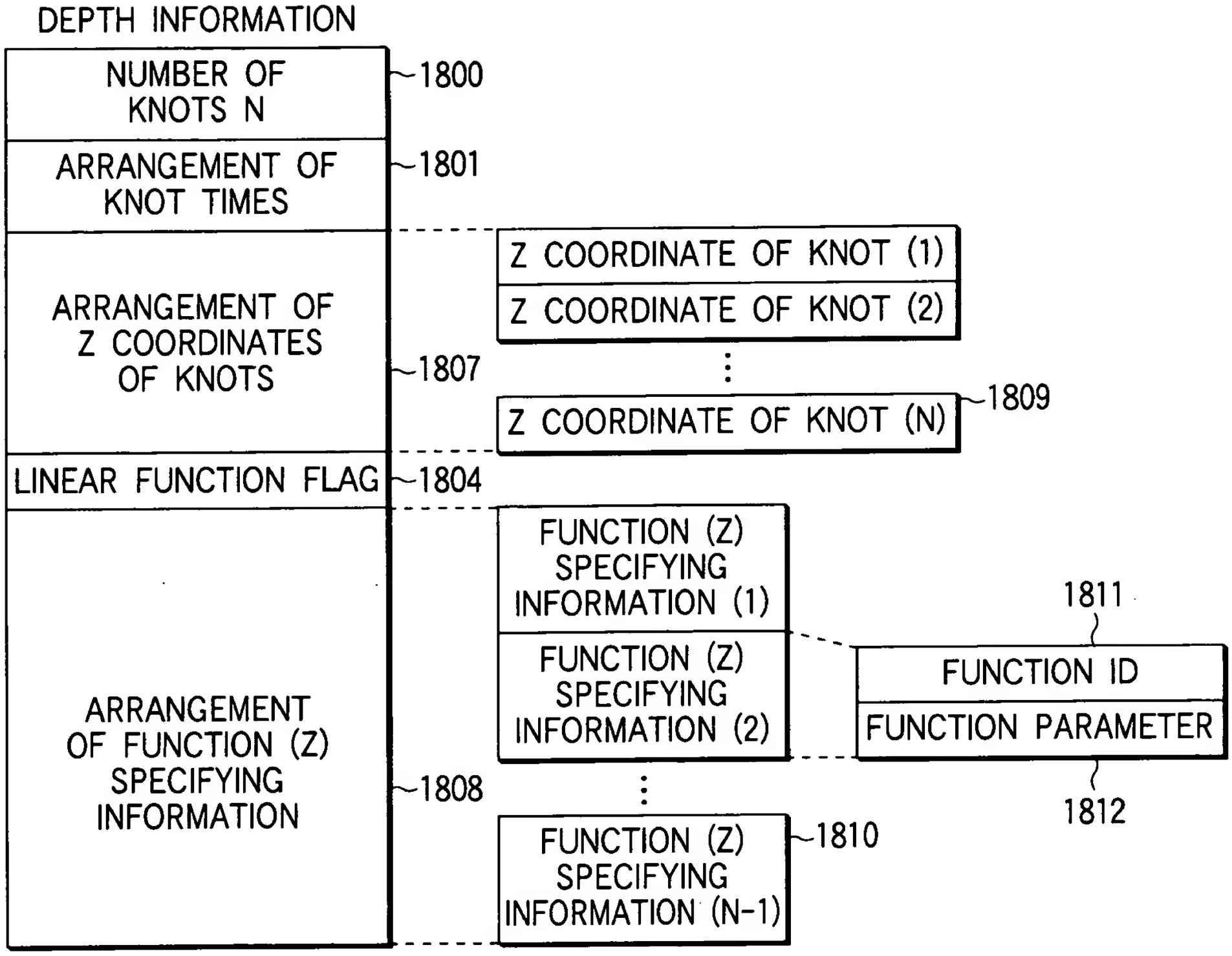

DEPTH INFORMATION
NUMBER OF KNOTS N
1800
ARRANGEMENT OF KNOT TIMES
1801
ARRANGEMENT OF Z COORDINATES OF KNOTS
1807
Z COORDINATE OF KNOT (1)
Z COORDINATE OF KNOT (2)
Z COORDINATE OF KNOT (N)
1809
LINEAR FUNCTION FLAG
1804
ARRANGEMENT OF FUNCTION (Z) SPECIFYING INFORMATION
1808
FUNCTION (Z) SPECIFYING INFORMATION (1)
FUNCTION (Z) SPECIFYING INFORMATION (2)
FUNCTION (Z) SPECIFYING INFORMATION (N-1)
1810
1811
FUNCTION ID
FUNCTION PARAMETER
1812

FIG. 18

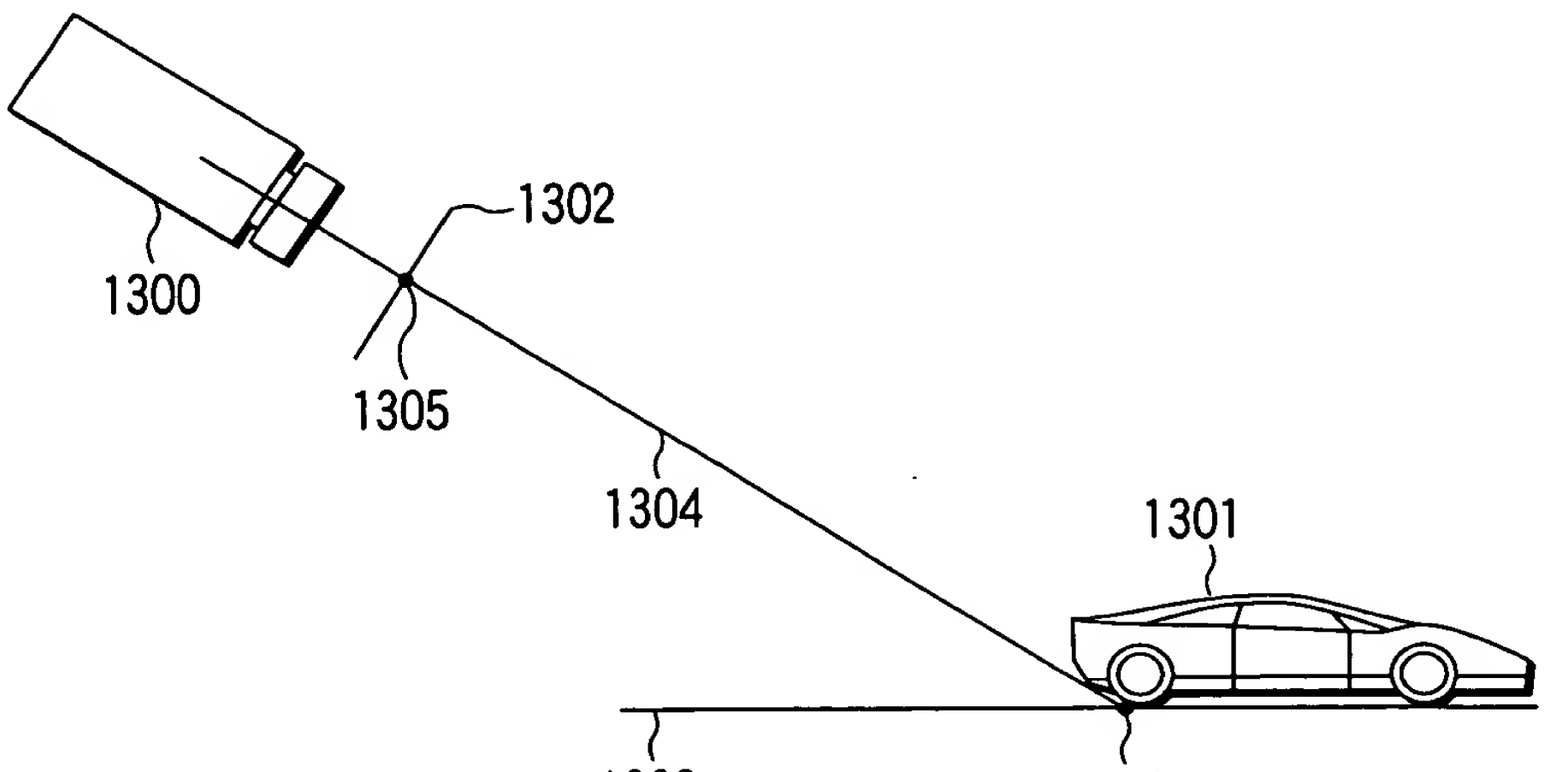


FIG. 19

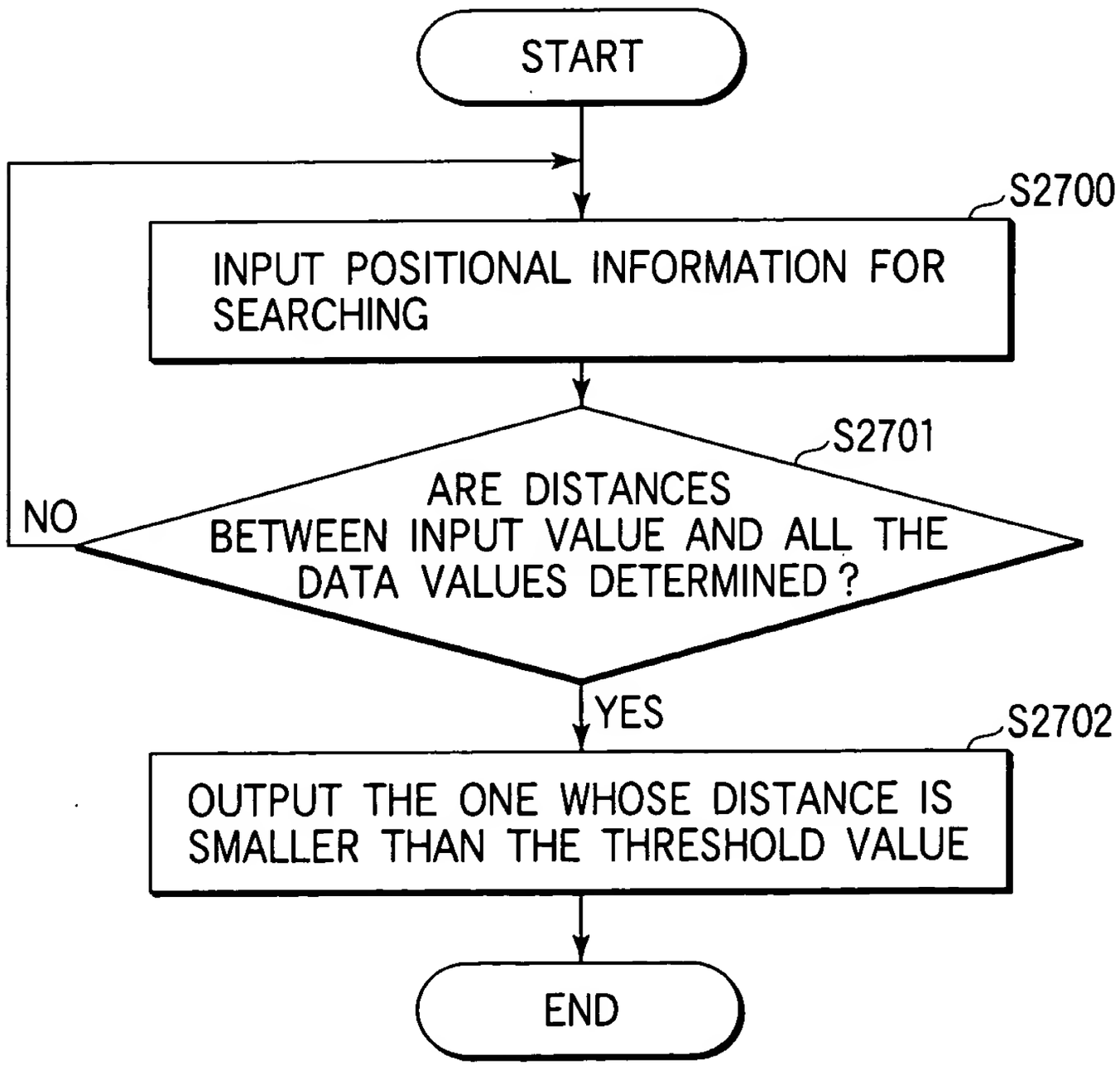
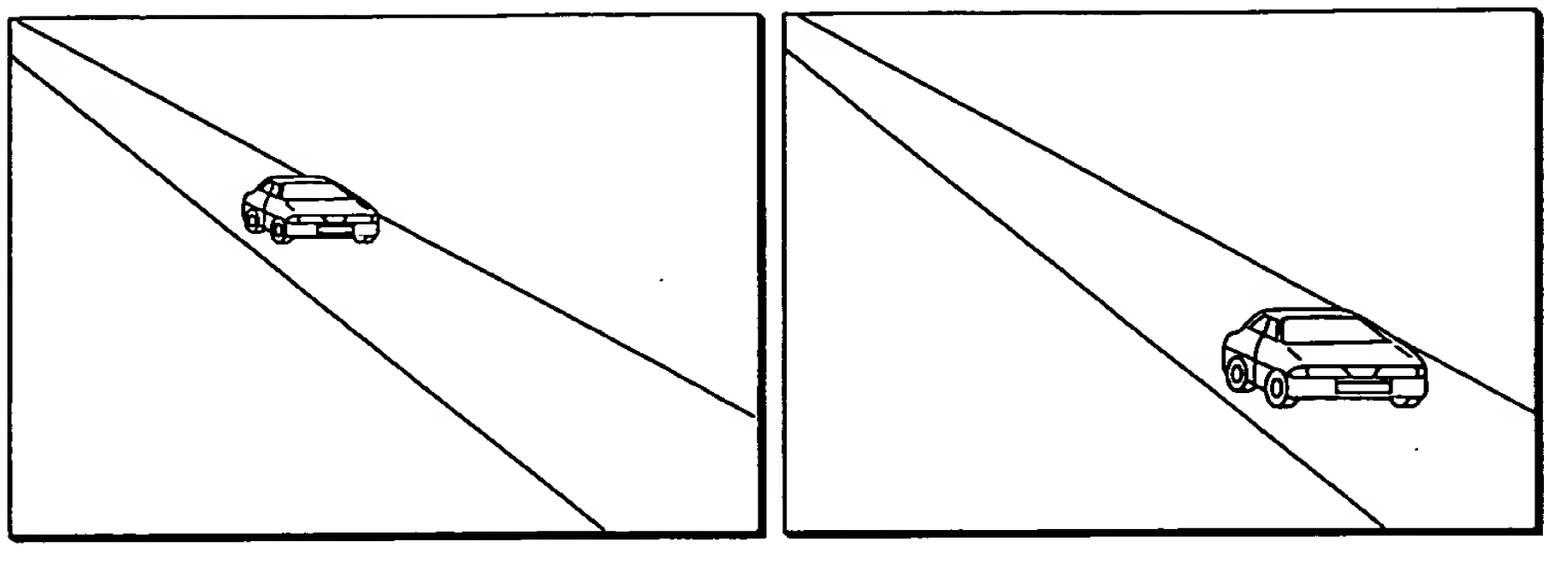
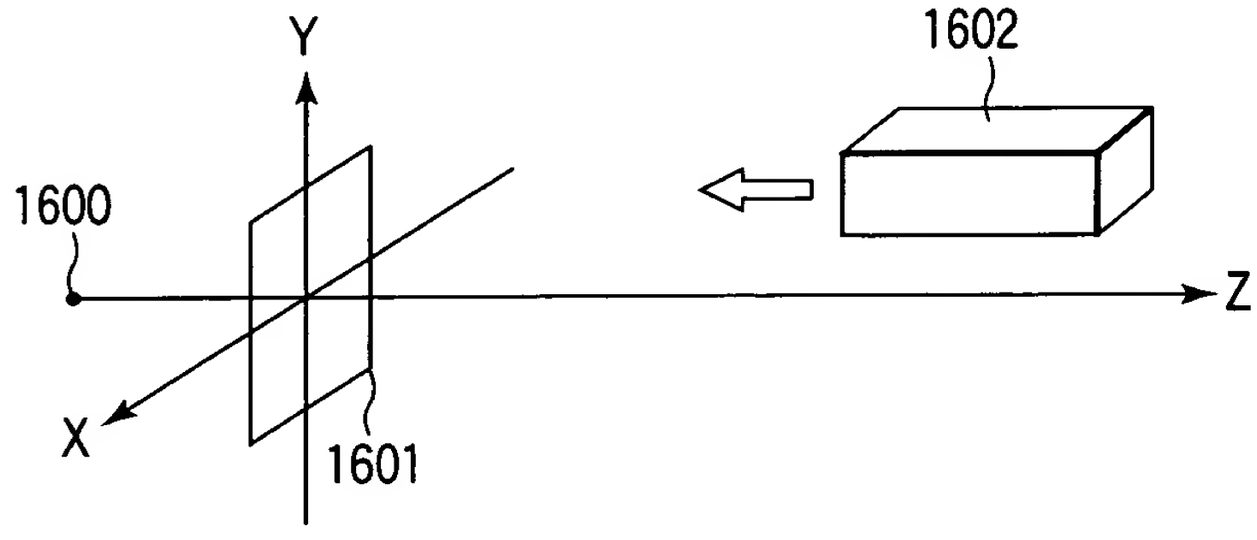


FIG. 20

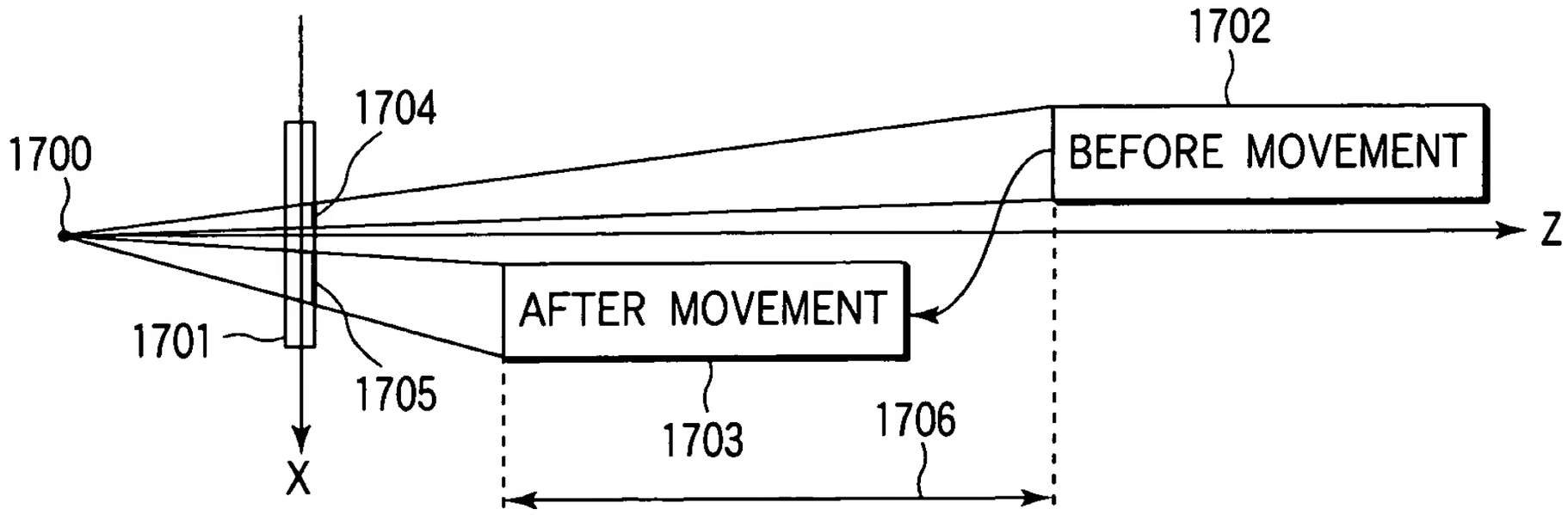


F I G. 21A

F I G. 21B



F I G. 22



F I G. 23

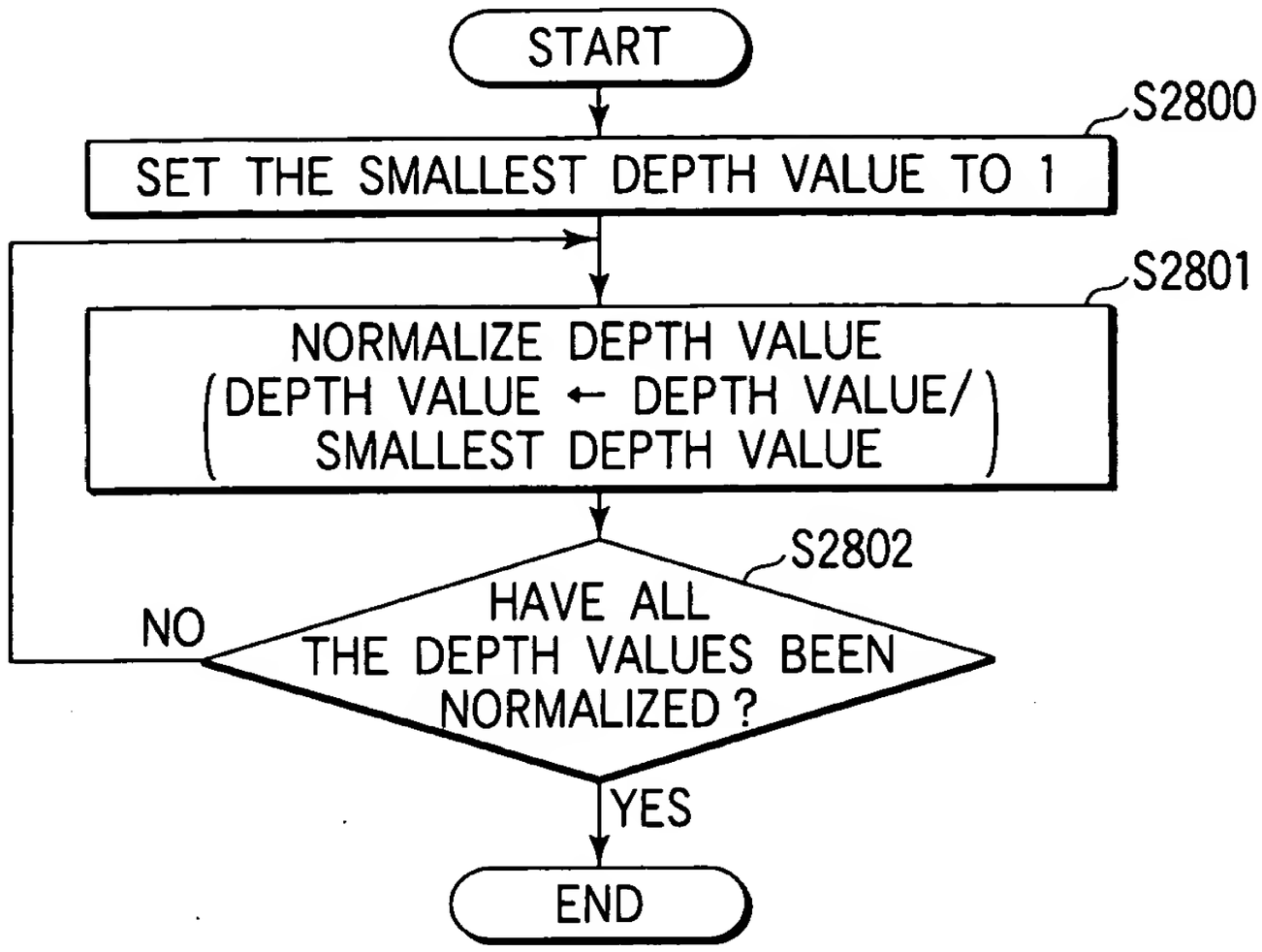

START
S2800
SET THE SMALLEST DEPTH VALUE TO 1
S2801
NORMALIZE DEPTH VALUE
(DEPTH VALUE ← DEPTH VALUE/
SMALLEST DEPTH VALUE)
S2802
HAVE ALL
THE DEPTH VALUES BEEN
NORMALIZED ?
NO
YES
END

FIG. 24

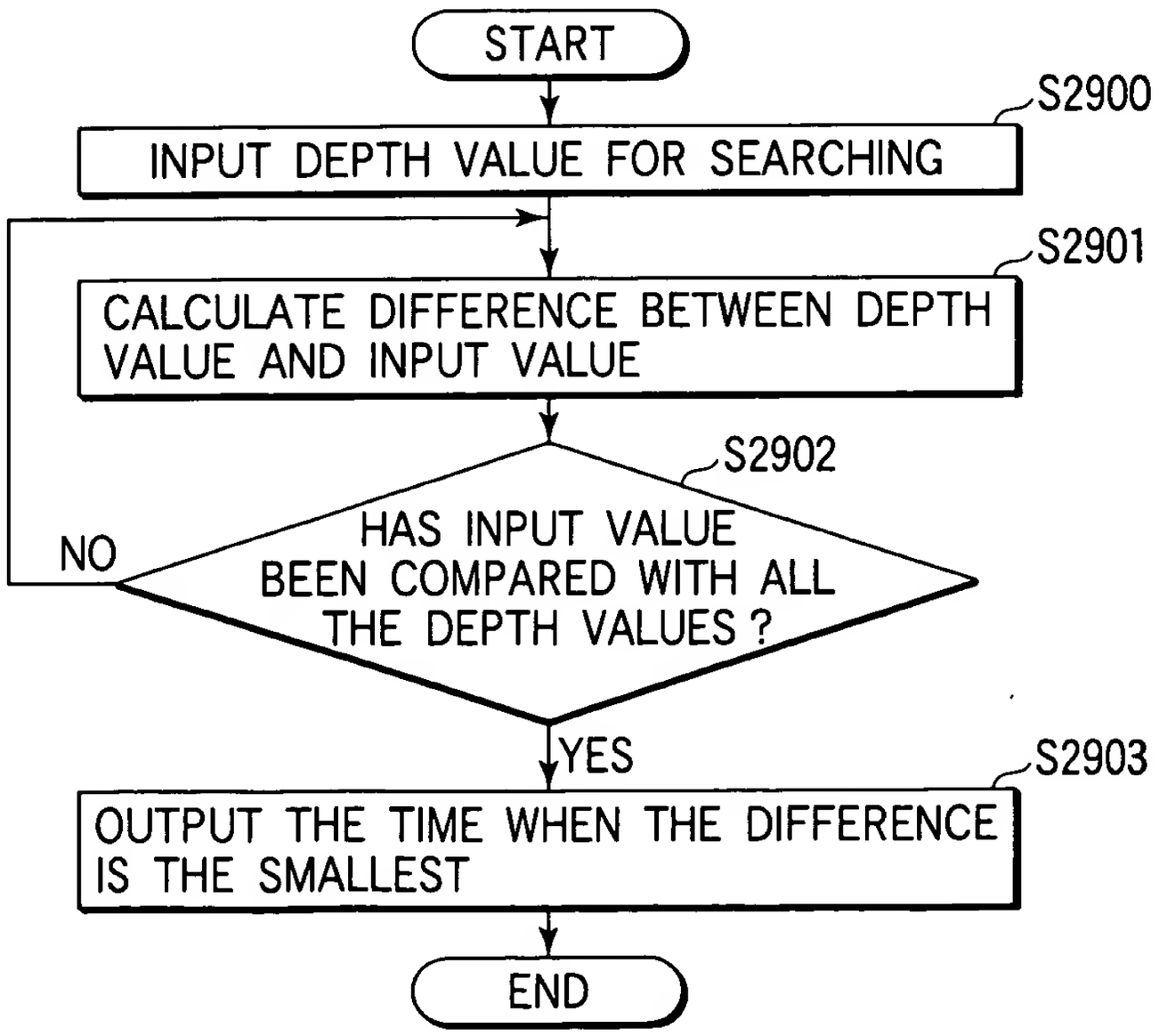

START
S2900
INPUT DEPTH VALUE FOR SEARCHING
S2901
CALCULATE DIFFERENCE BETWEEN DEPTH
VALUE AND INPUT VALUE
S2902
HAS INPUT VALUE
BEEN COMPARED WITH ALL
THE DEPTH VALUES ?
NO
YES
S2903
OUTPUT THE TIME WHEN THE DIFFERENCE
IS THE SMALLEST
END

FIG. 25

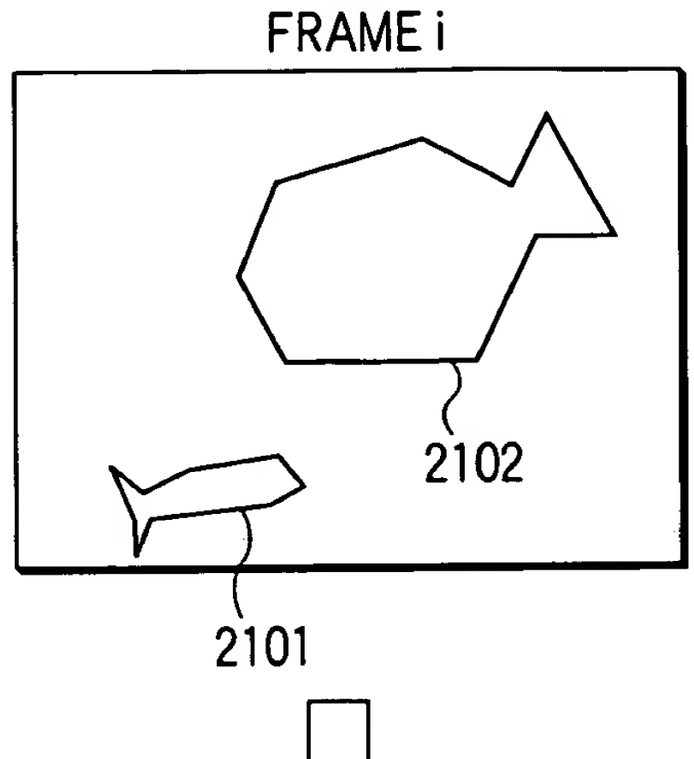


FIG. 26A

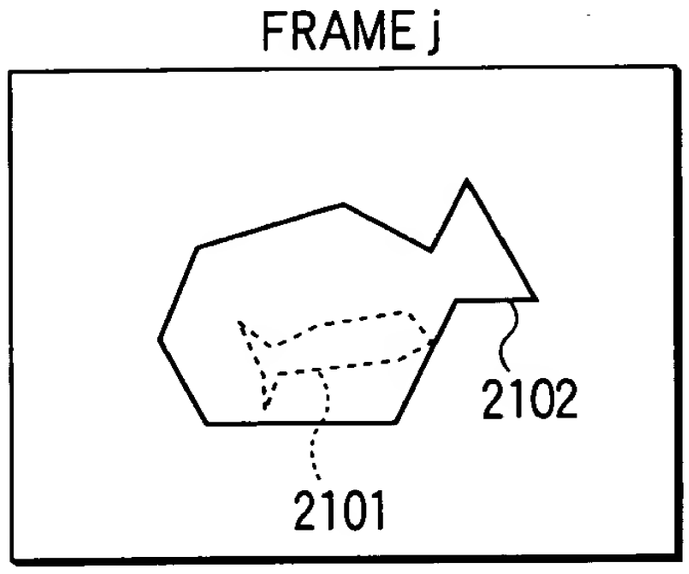


FIG. 26B

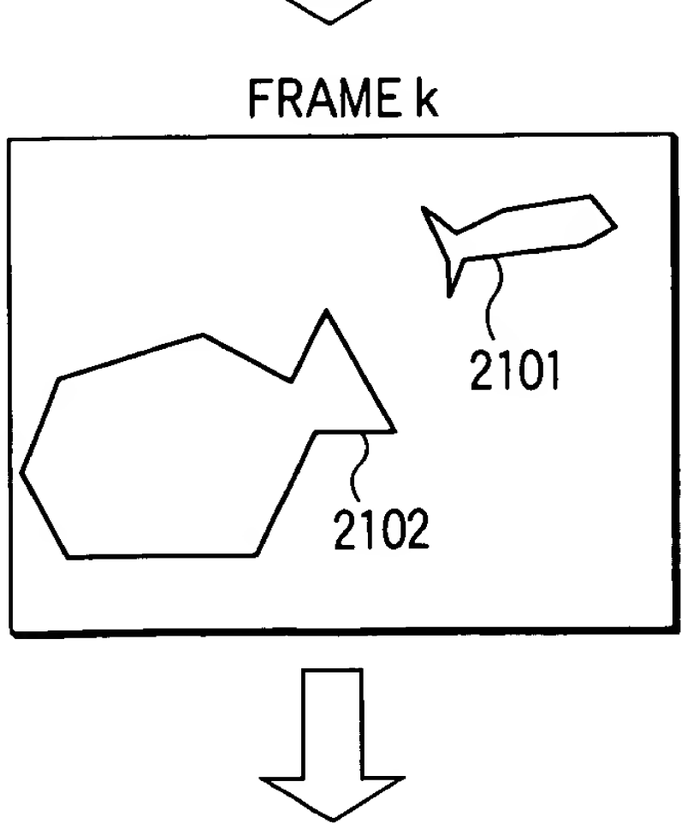
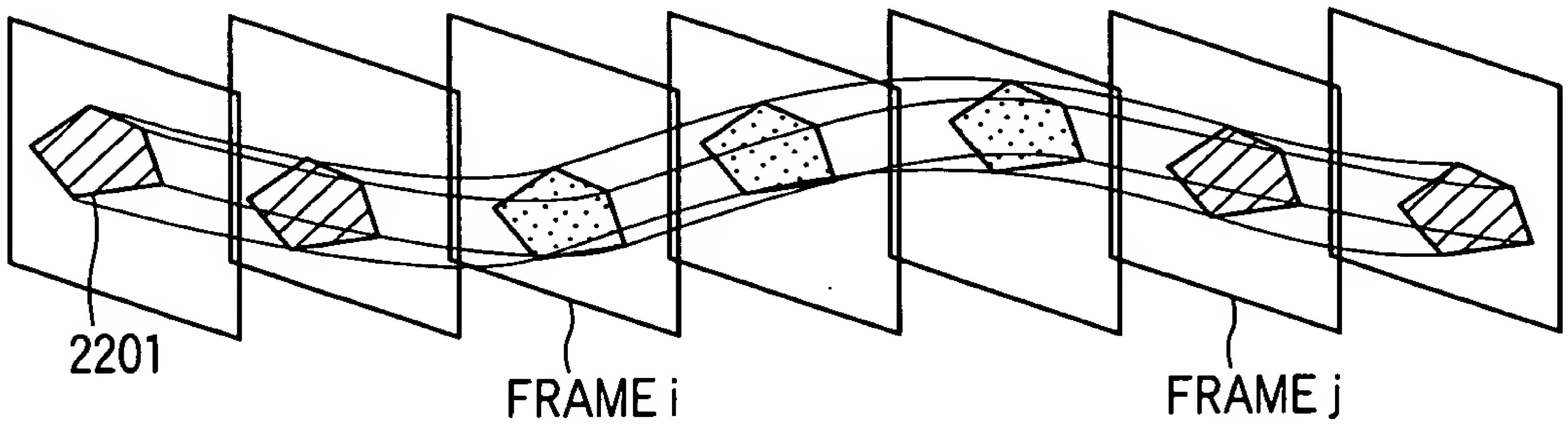
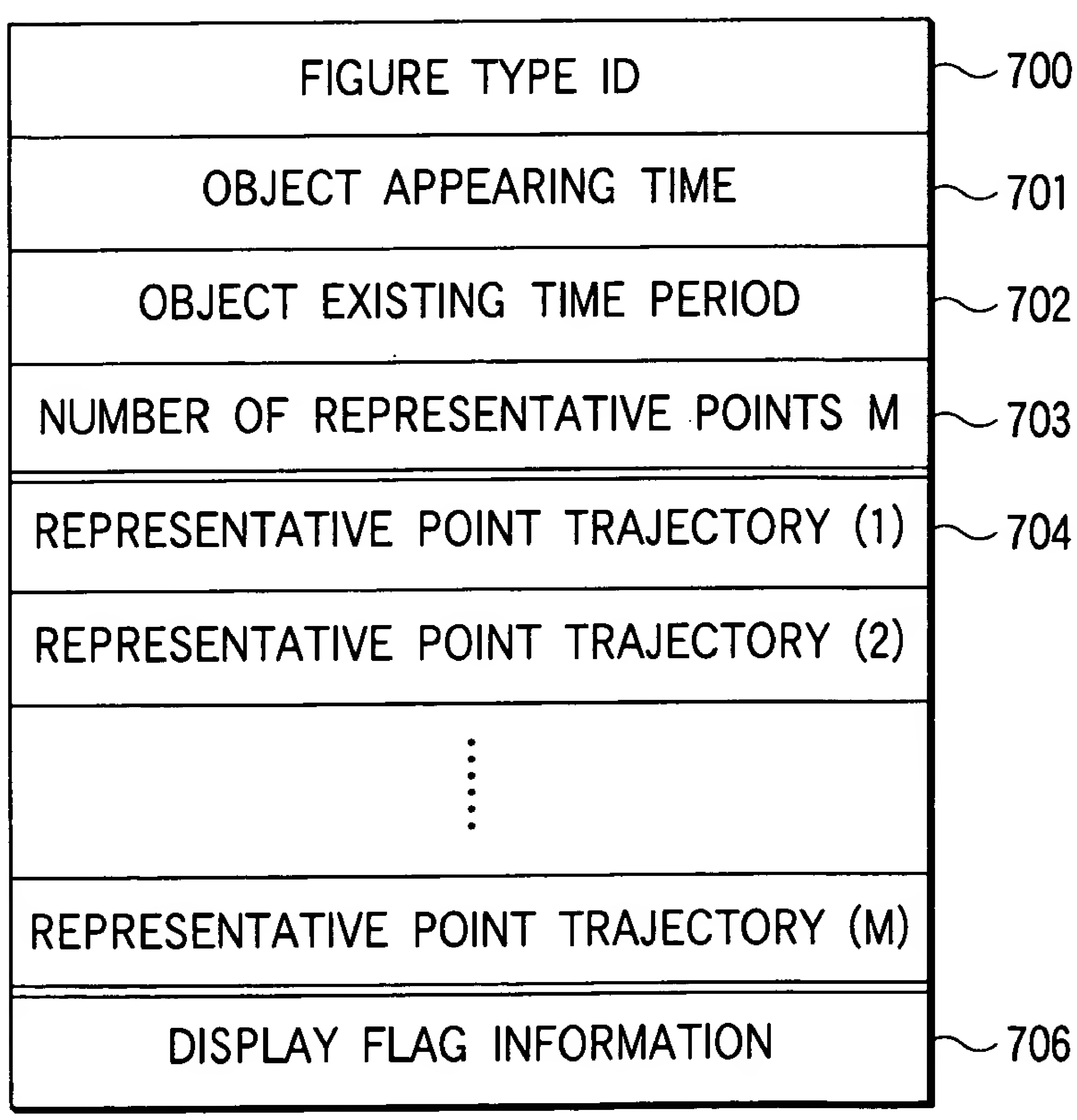


FIG. 26C



F I G. 27



F I G. 28

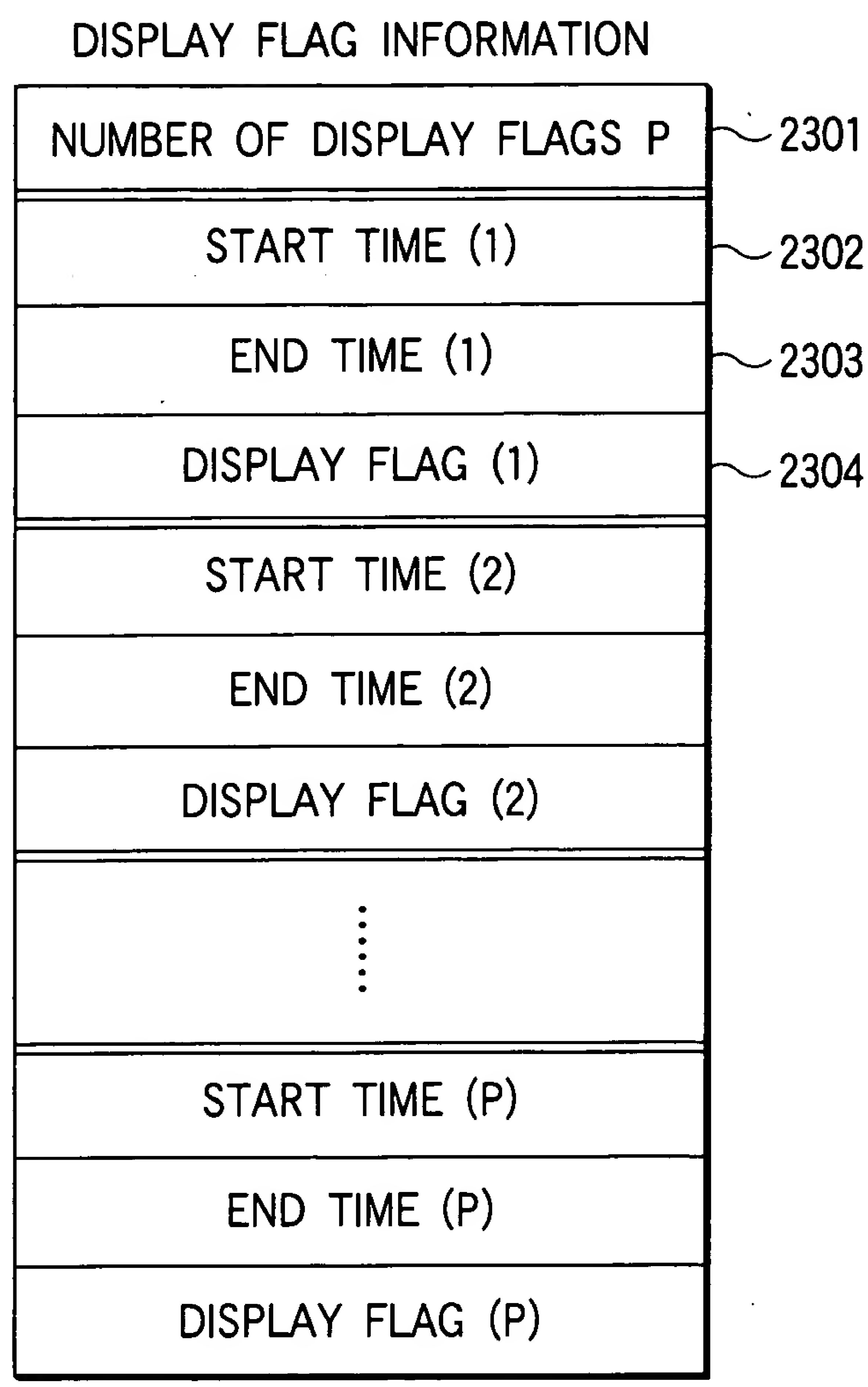


FIG. 29

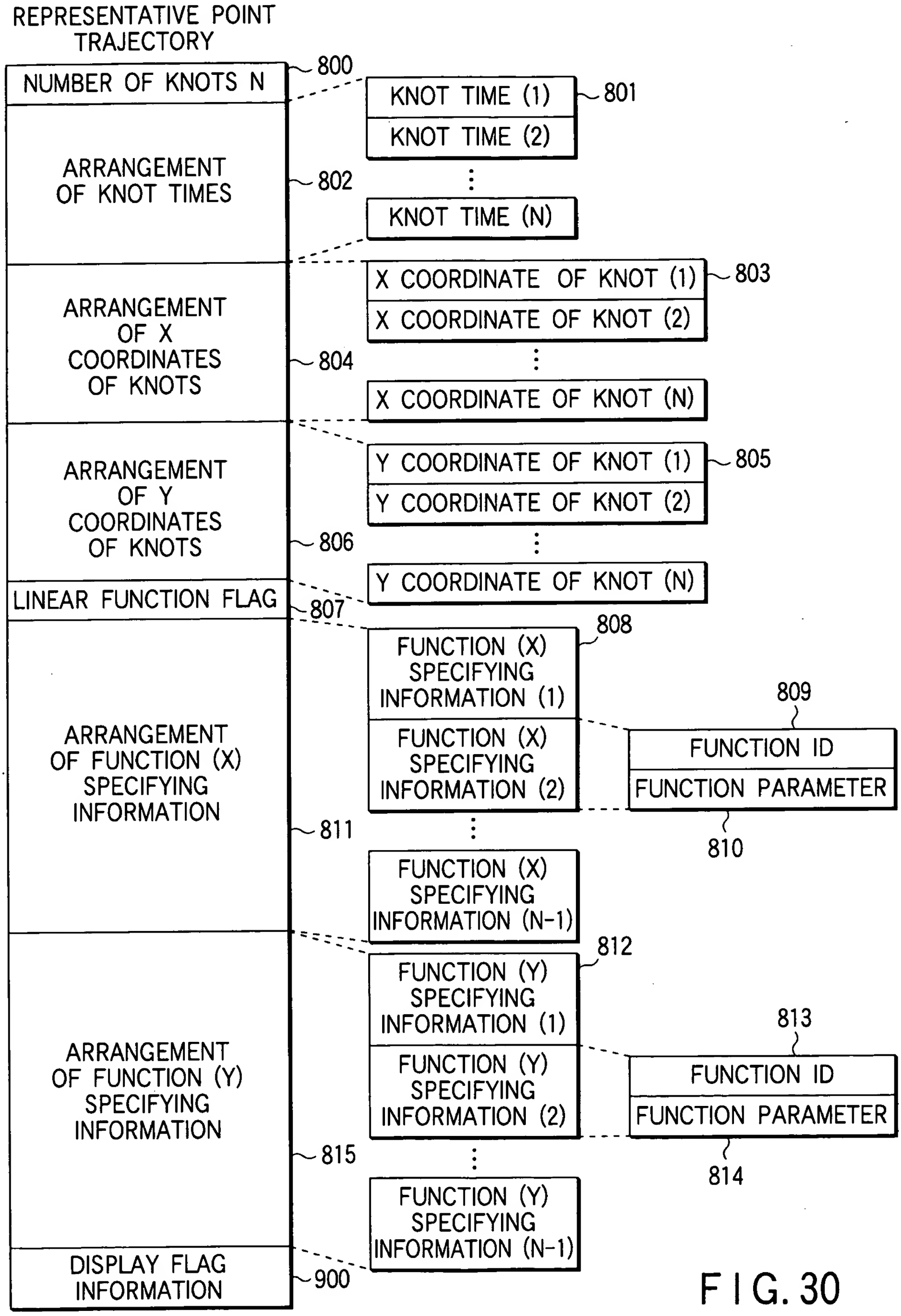

REPRESENTATIVE POINT TRAJECTORY
NUMBER OF KNOTS N
800
KNOT TIME (1)
KNOT TIME (2)
KNOT TIME (N)
801
ARRANGEMENT OF KNOT TIMES
802
ARRANGEMENT OF X COORDINATES OF KNOTS
804
X COORDINATE OF KNOT (1)
X COORDINATE OF KNOT (2)
X COORDINATE OF KNOT (N)
803
ARRANGEMENT OF Y COORDINATES OF KNOTS
806
Y COORDINATE OF KNOT (1)
Y COORDINATE OF KNOT (2)
Y COORDINATE OF KNOT (N)
805
LINEAR FUNCTION FLAG
807
ARRANGEMENT OF FUNCTION (X) SPECIFYING INFORMATION
811
FUNCTION (X) SPECIFYING INFORMATION (1)
FUNCTION (X) SPECIFYING INFORMATION (2)
FUNCTION (X) SPECIFYING INFORMATION (N-1)
808
FUNCTION ID
FUNCTION PARAMETER
809
810
ARRANGEMENT OF FUNCTION (Y) SPECIFYING INFORMATION
815
FUNCTION (Y) SPECIFYING INFORMATION (1)
FUNCTION (Y) SPECIFYING INFORMATION (2)
FUNCTION (Y) SPECIFYING INFORMATION (N-1)
812
FUNCTION ID
FUNCTION PARAMETER
813
814
DISPLAY FLAG INFORMATION
900

FIG. 30

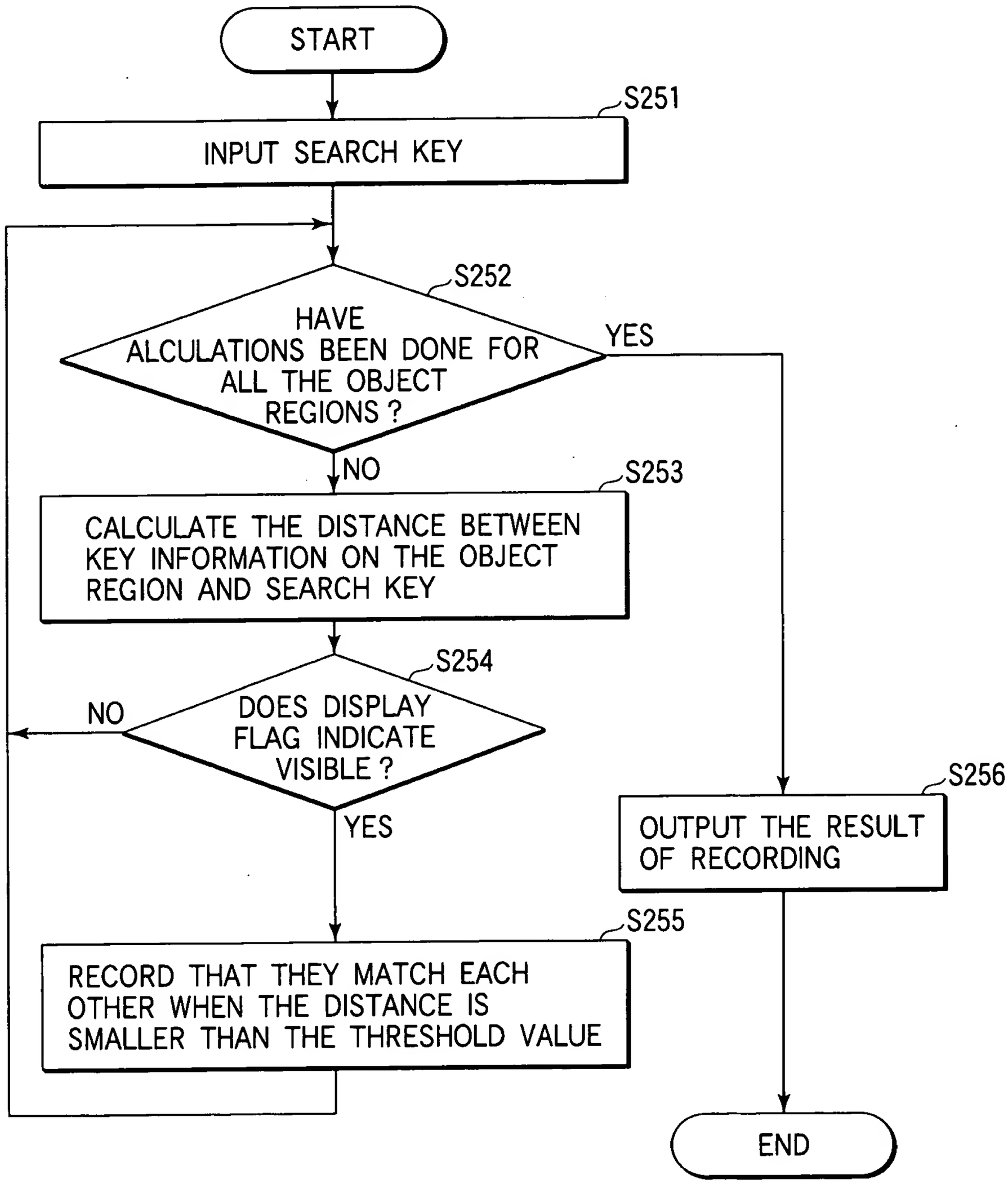

START
S251
INPUT SEARCH KEY
S252
HAVE ALCULATIONS BEEN DONE FOR ALL THE OBJECT REGIONS ?
YES
NO
S253
CALCULATE THE DISTANCE BETWEEN KEY INFORMATION ON THE OBJECT REGION AND SEARCH KEY
S254
DOES DISPLAY FLAG INDICATE VISIBLE ?
NO
YES
S255
RECORD THAT THEY MATCH EACH OTHER WHEN THE DISTANCE IS SMALLER THAN THE THRESHOLD VALUE
S256
OUTPUT THE RESULT OF RECORDING
END

FIG. 31

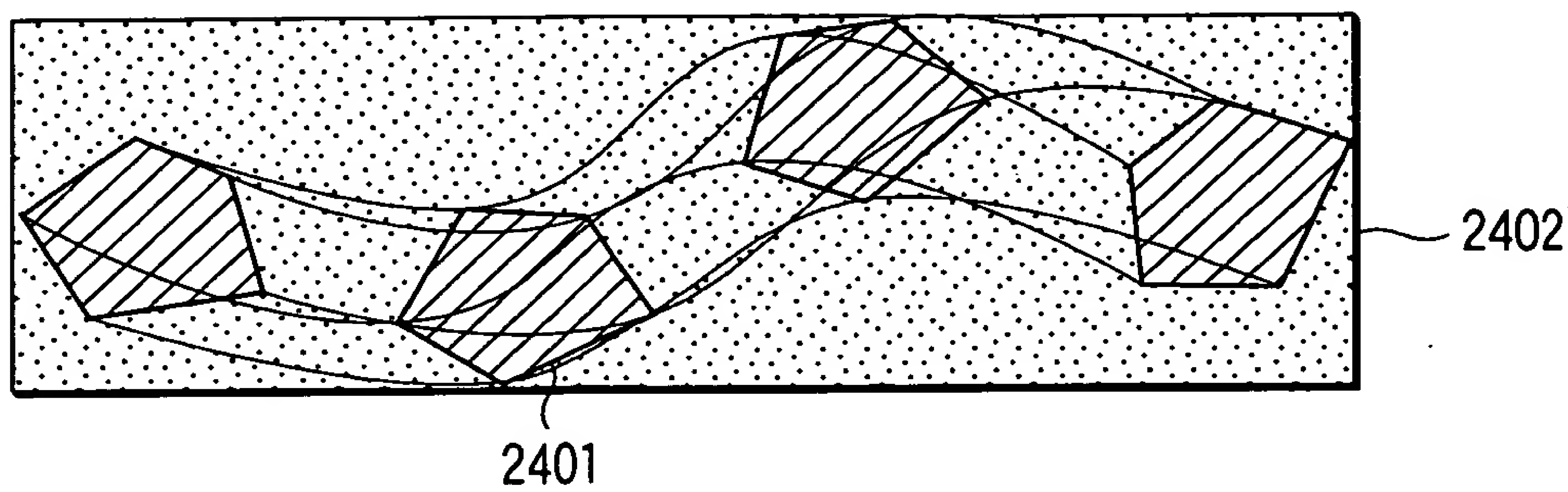


FIG. 32A

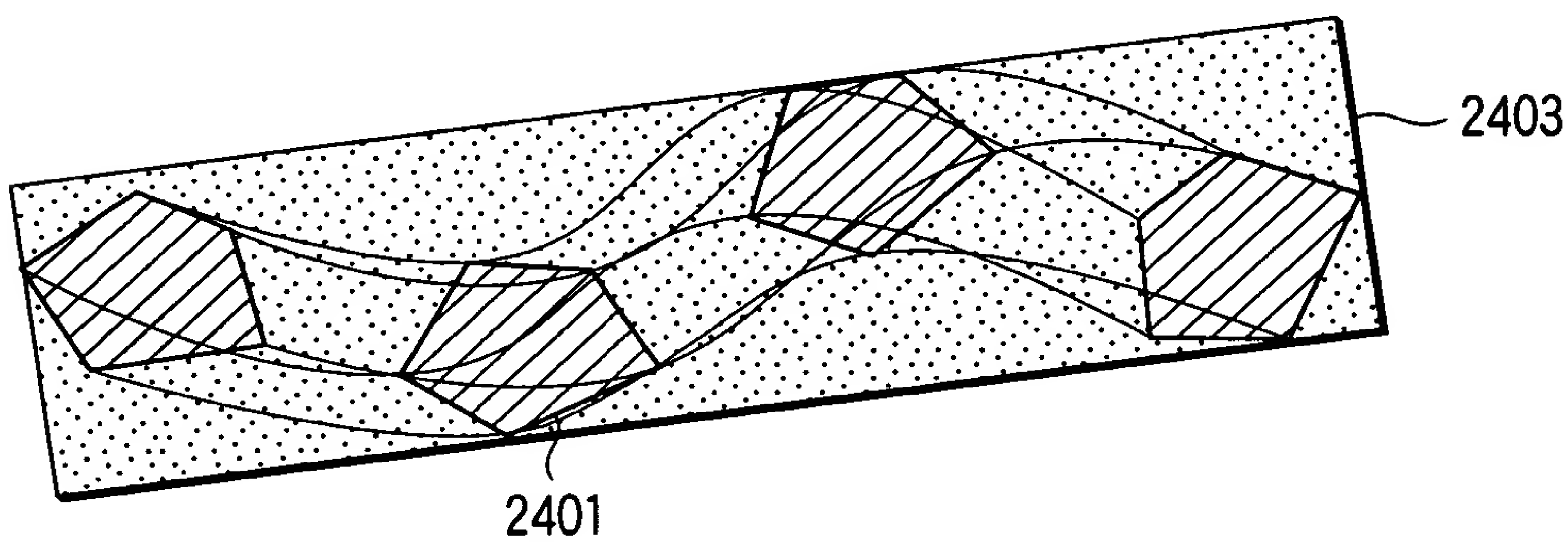


FIG. 32B

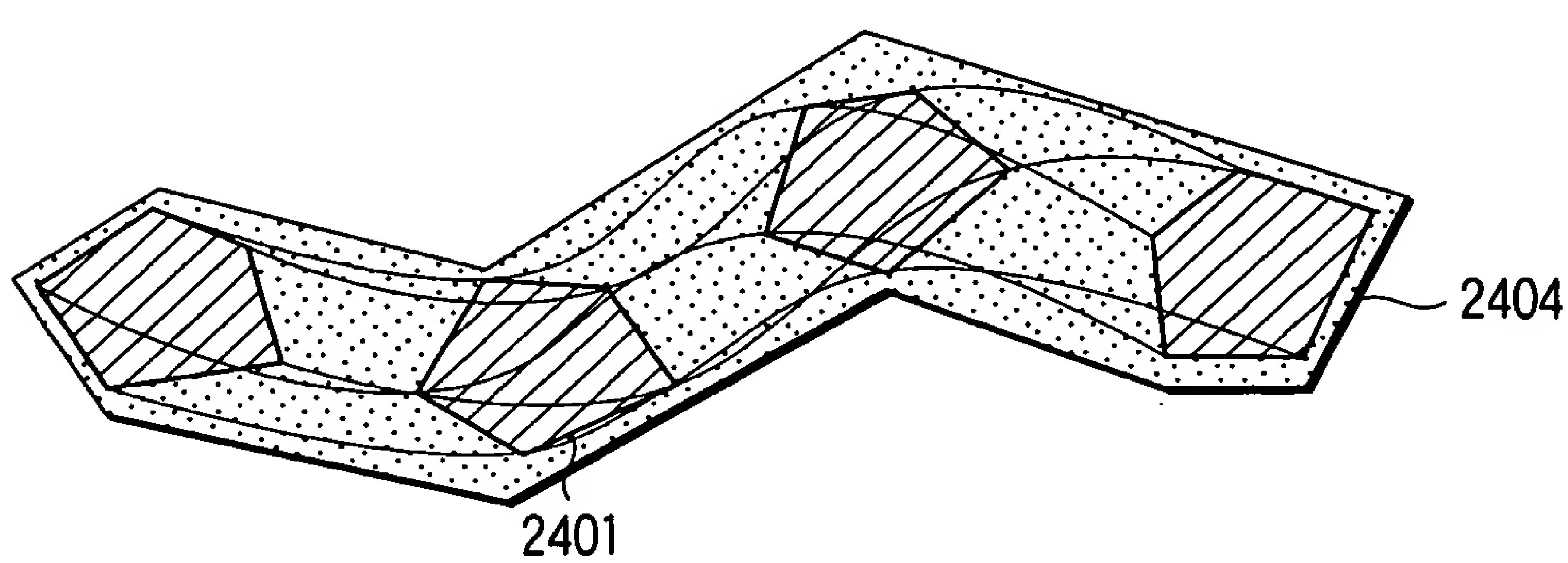


FIG. 32C

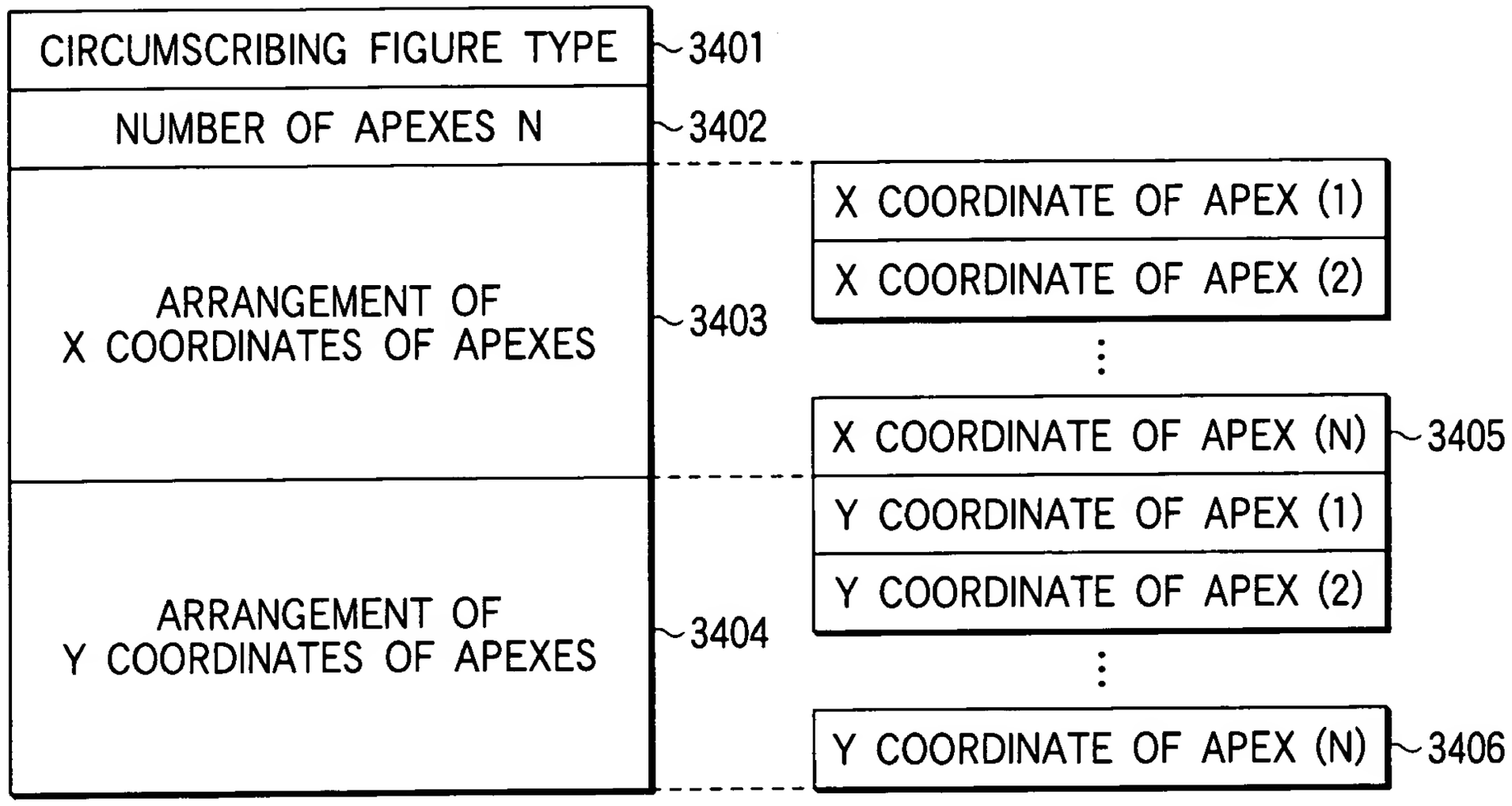

CIRCUMSCRIBING FIGURE TYPE
3401
NUMBER OF APEXES N
3402
ARRANGEMENT OF X COORDINATES OF APEXES
3403
ARRANGEMENT OF Y COORDINATES OF APEXES
3404
X COORDINATE OF APEX (1)
X COORDINATE OF APEX (2)
X COORDINATE OF APEX (N)
3405
Y COORDINATE OF APEX (1)
Y COORDINATE OF APEX (2)
Y COORDINATE OF APEX (N)
3406

FIG. 33

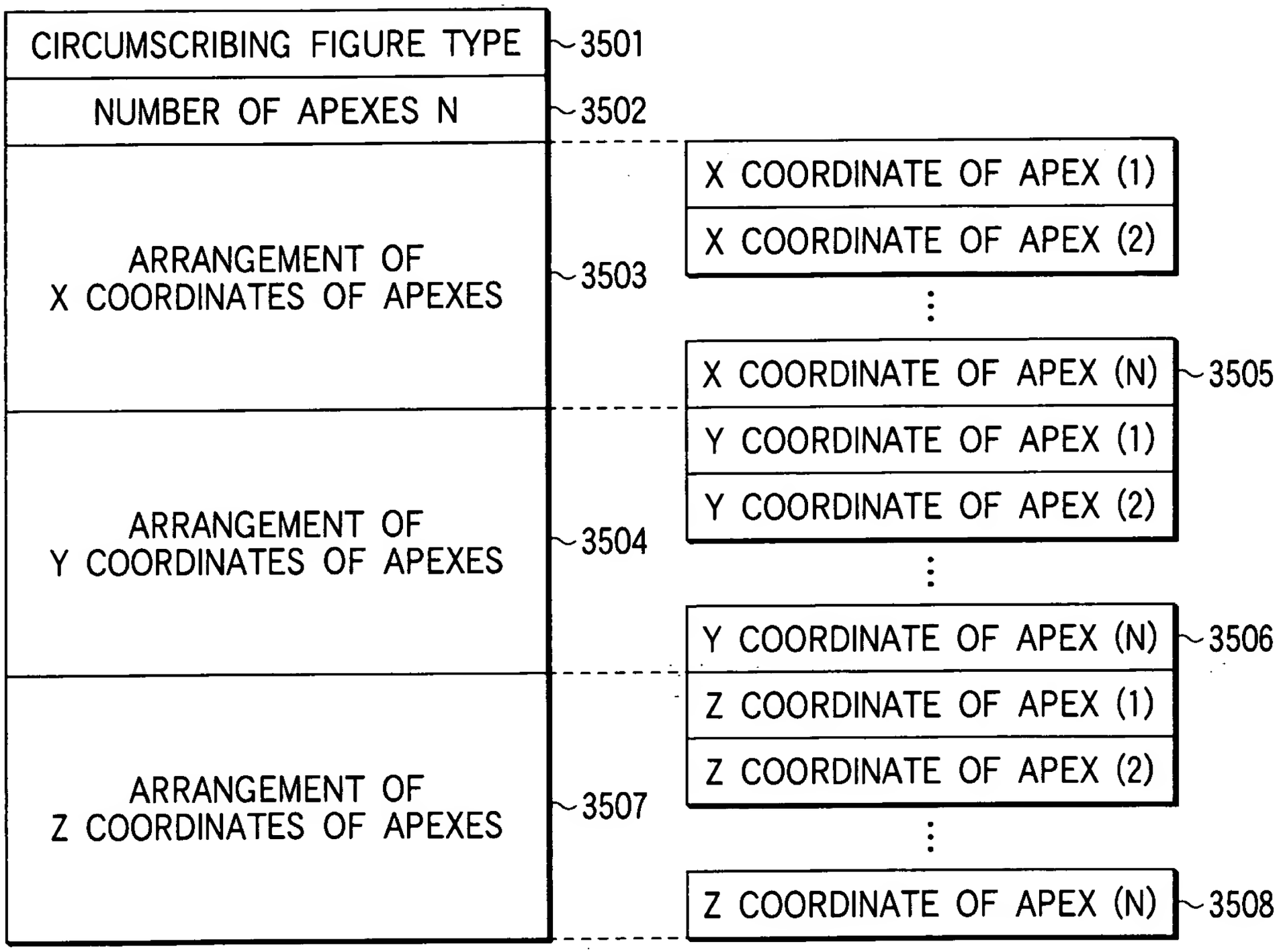

CIRCUMSCRIBING FIGURE TYPE
3501
NUMBER OF APEXES N
3502
ARRANGEMENT OF X COORDINATES OF APEXES
3503
X COORDINATE OF APEX (1)
X COORDINATE OF APEX (2)
X COORDINATE OF APEX (N)
3505
ARRANGEMENT OF Y COORDINATES OF APEXES
3504
Y COORDINATE OF APEX (1)
Y COORDINATE OF APEX (2)
Y COORDINATE OF APEX (N)
3506
ARRANGEMENT OF Z COORDINATES OF APEXES
3507
Z COORDINATE OF APEX (1)
Z COORDINATE OF APEX (2)
Z COORDINATE OF APEX (N)
3508

FIG. 34

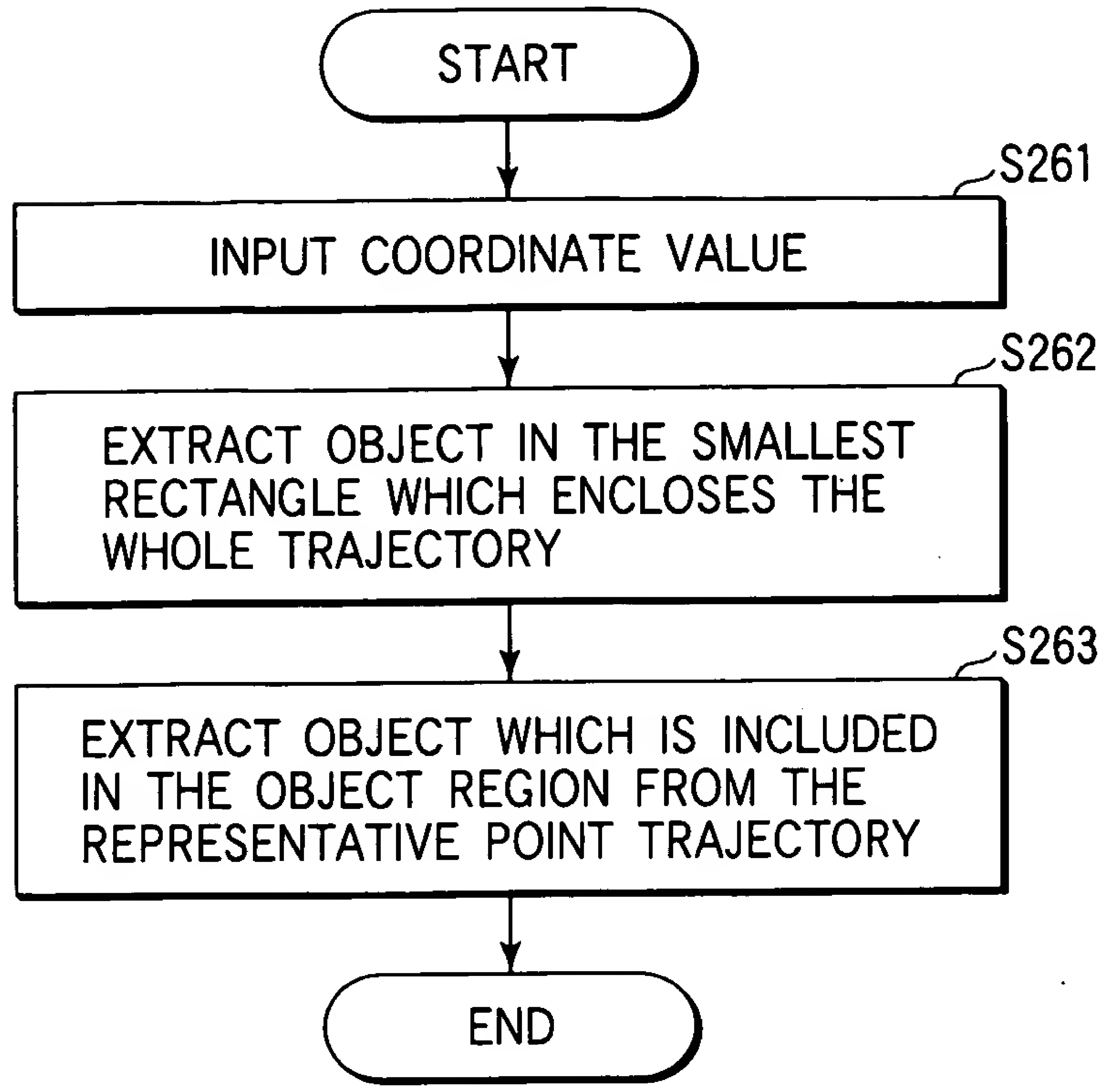


FIG. 35

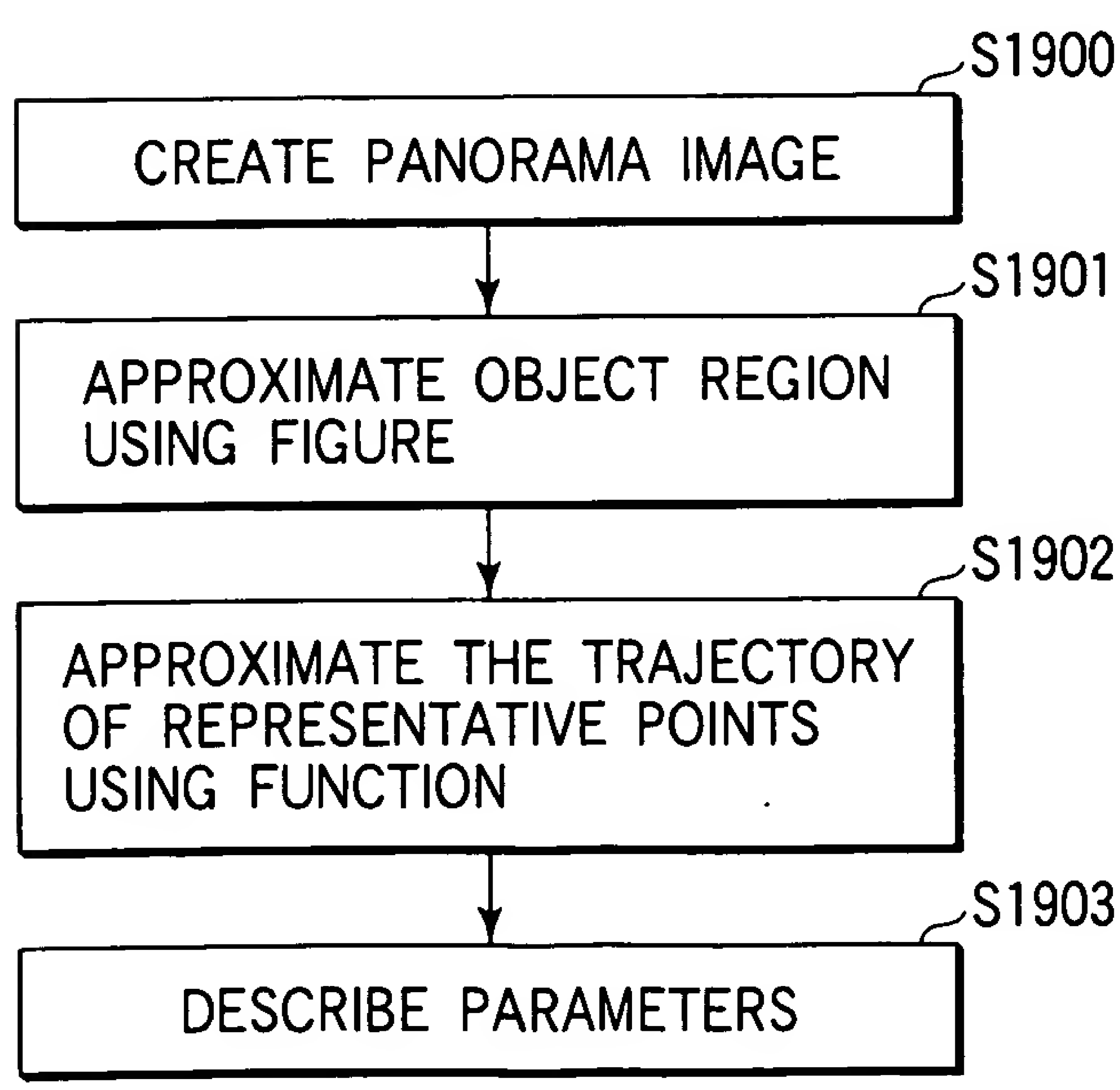


FIG. 36

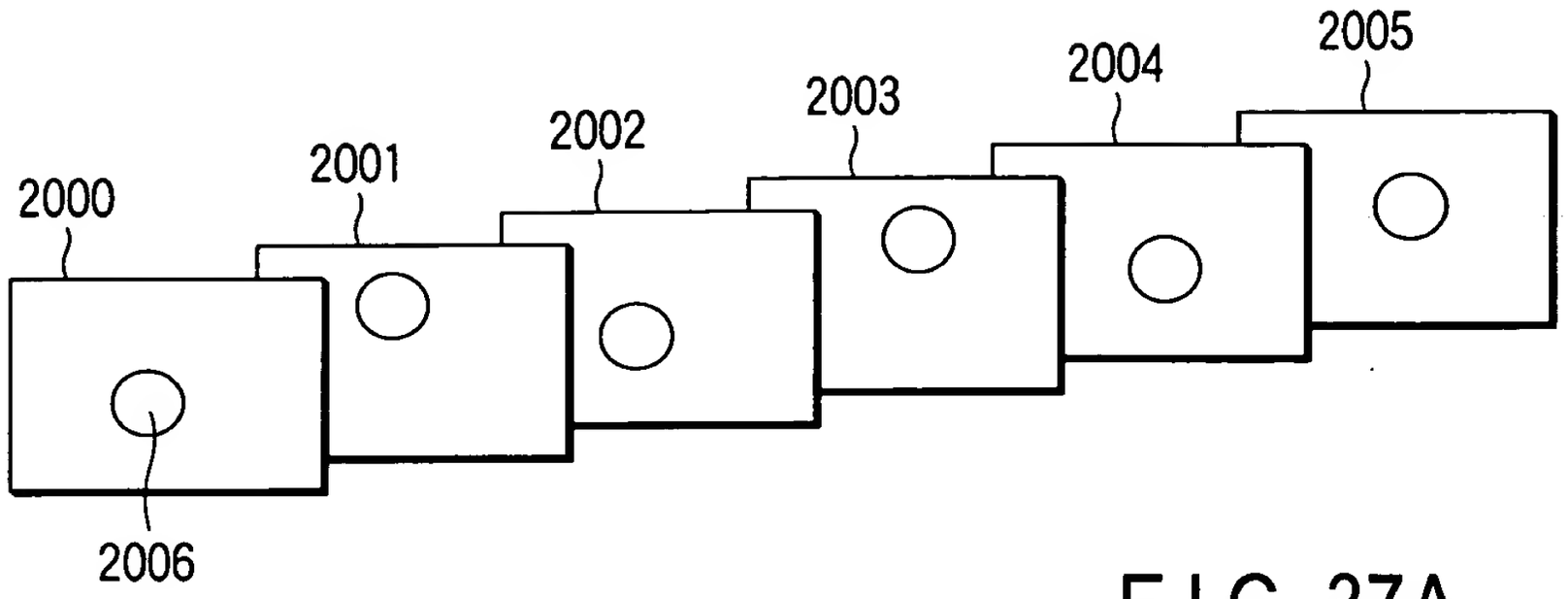


FIG. 37A

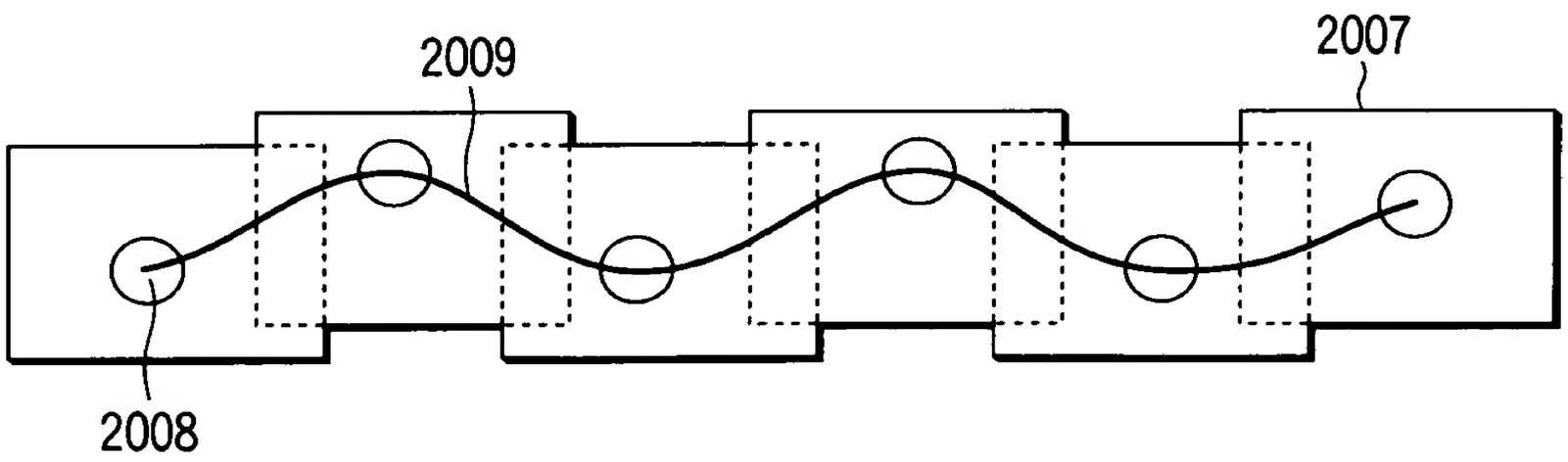


FIG. 37B

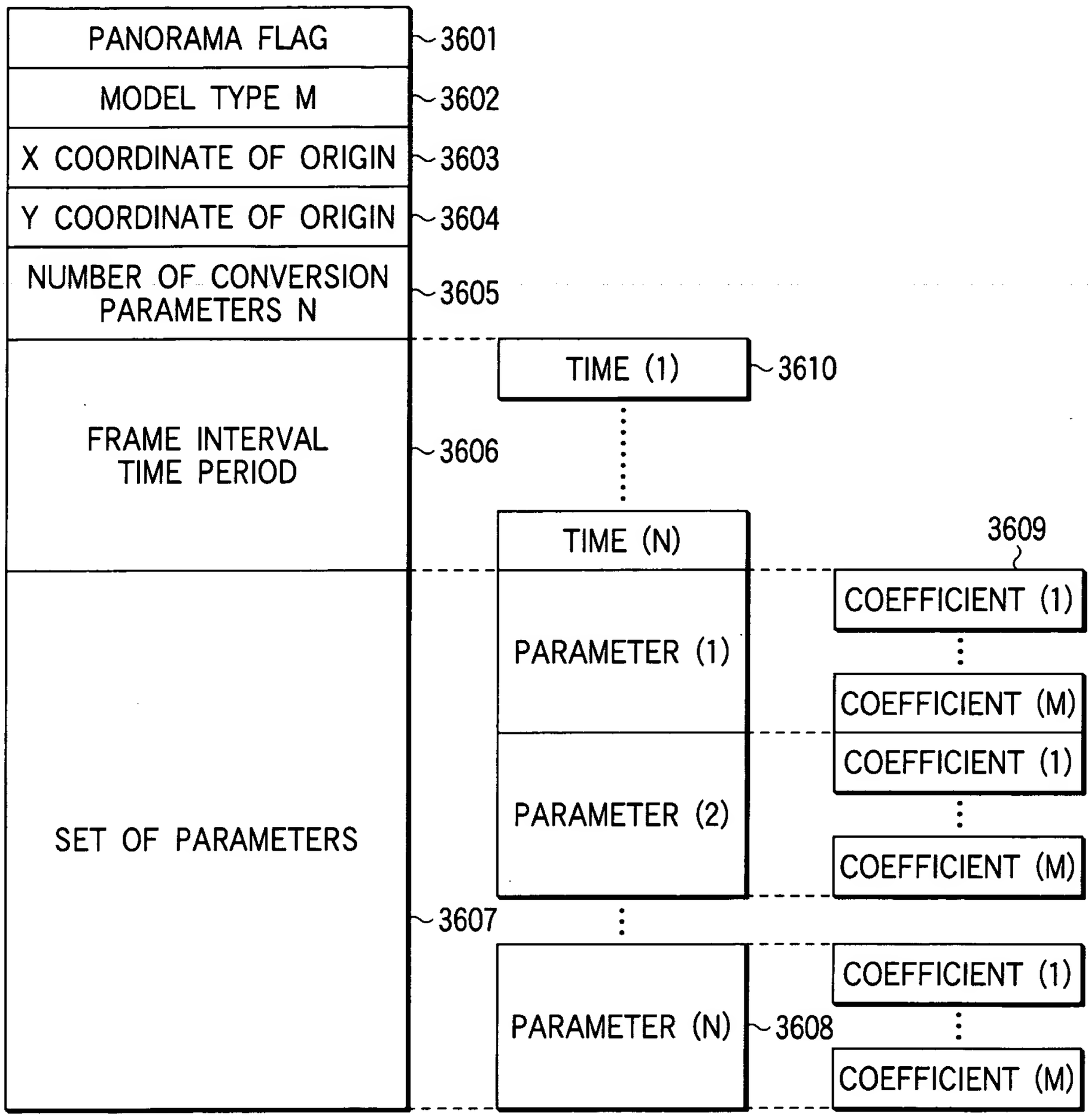

PANORAMA FLAG
3601
MODEL TYPE M
3602
X COORDINATE OF ORIGIN
3603
Y COORDINATE OF ORIGIN
3604
NUMBER OF CONVERSION PARAMETERS N
3605
FRAME INTERVAL TIME PERIOD
3606
SET OF PARAMETERS
3607
TIME (1)
3610
TIME (N)
PARAMETER (1)
PARAMETER (2)
PARAMETER (N)
3608
3609
COEFFICIENT (1)
COEFFICIENT (M)
COEFFICIENT (1)
COEFFICIENT (M)
COEFFICIENT (1)
COEFFICIENT (M)

FIG. 38

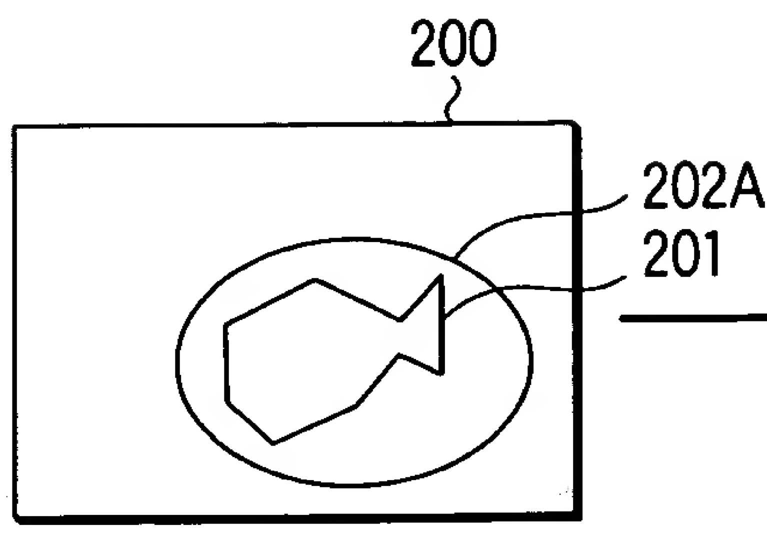


FIG. 39A

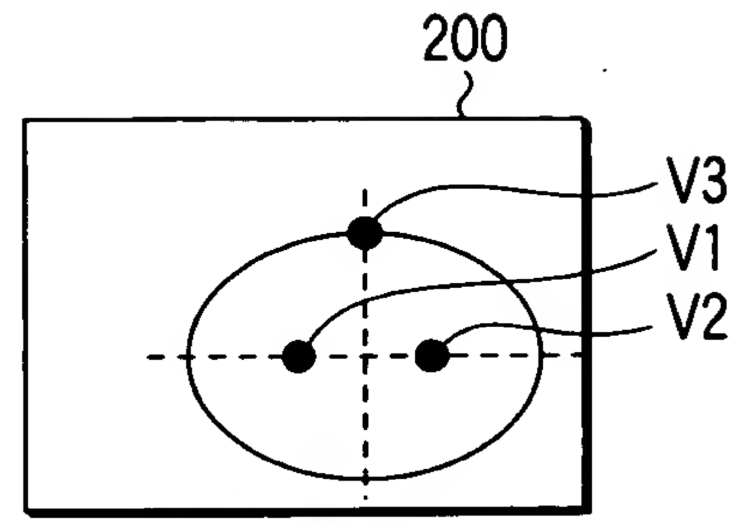


FIG. 39B

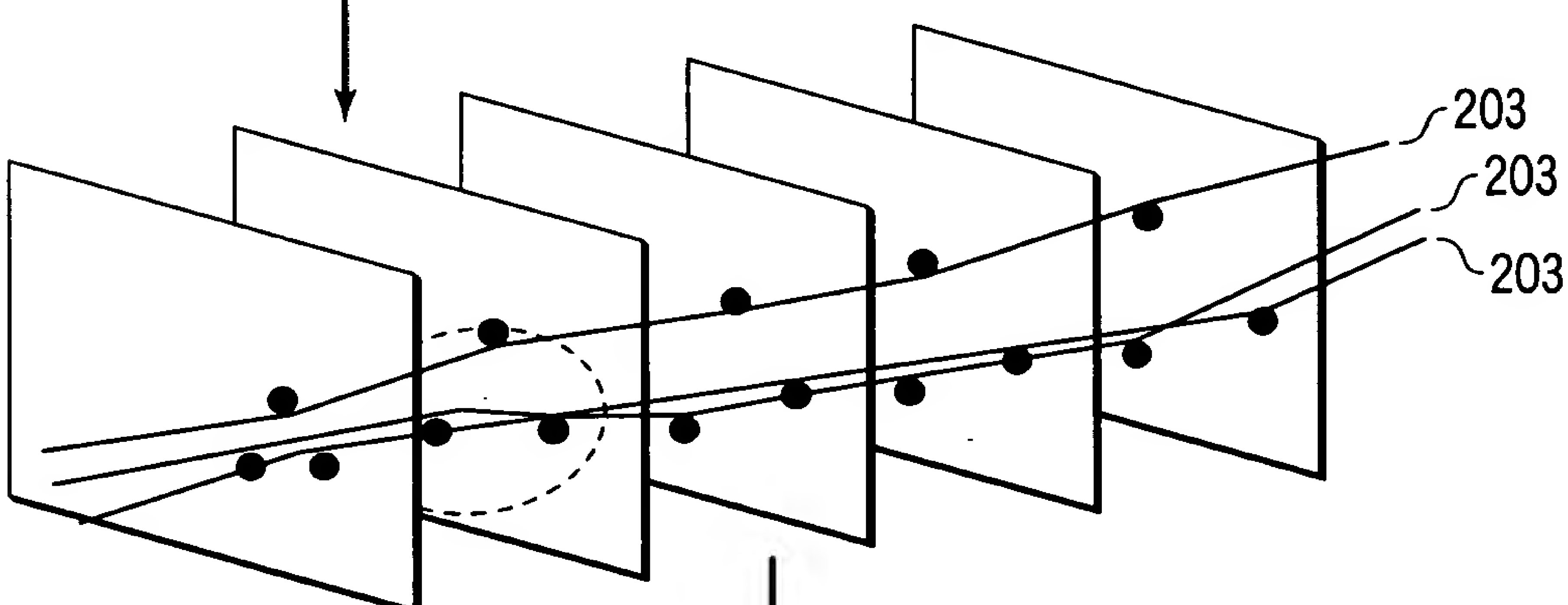


FIG. 39C

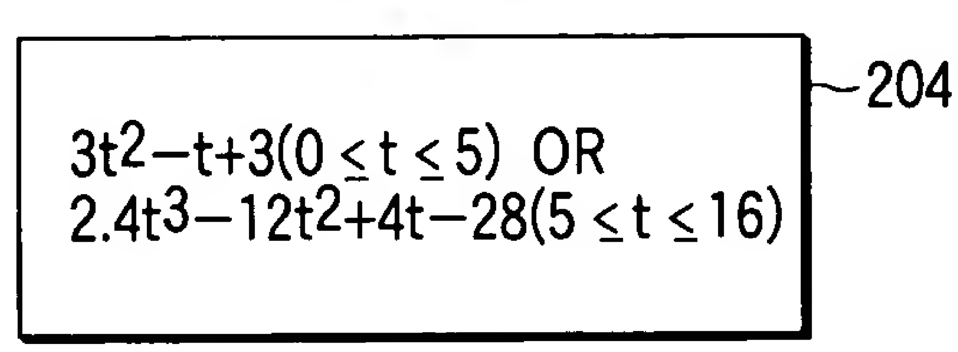


FIG. 39D

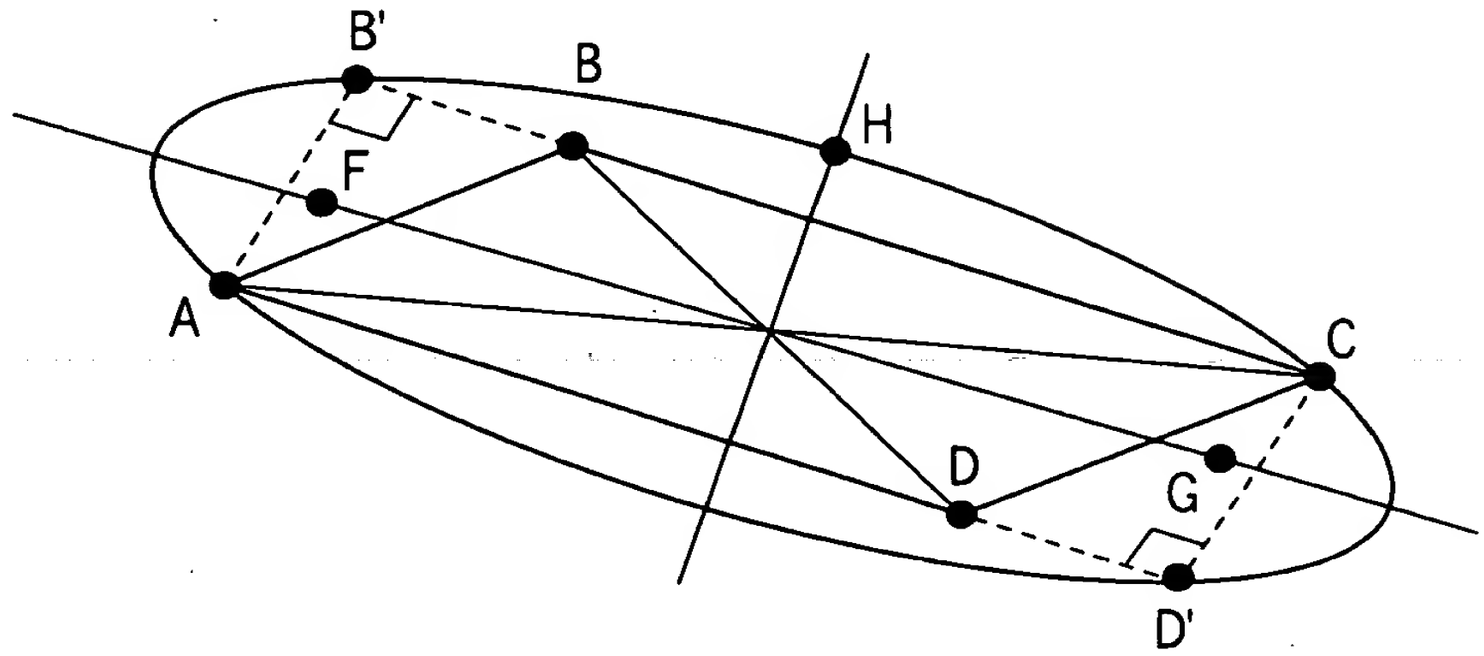


FIG. 40

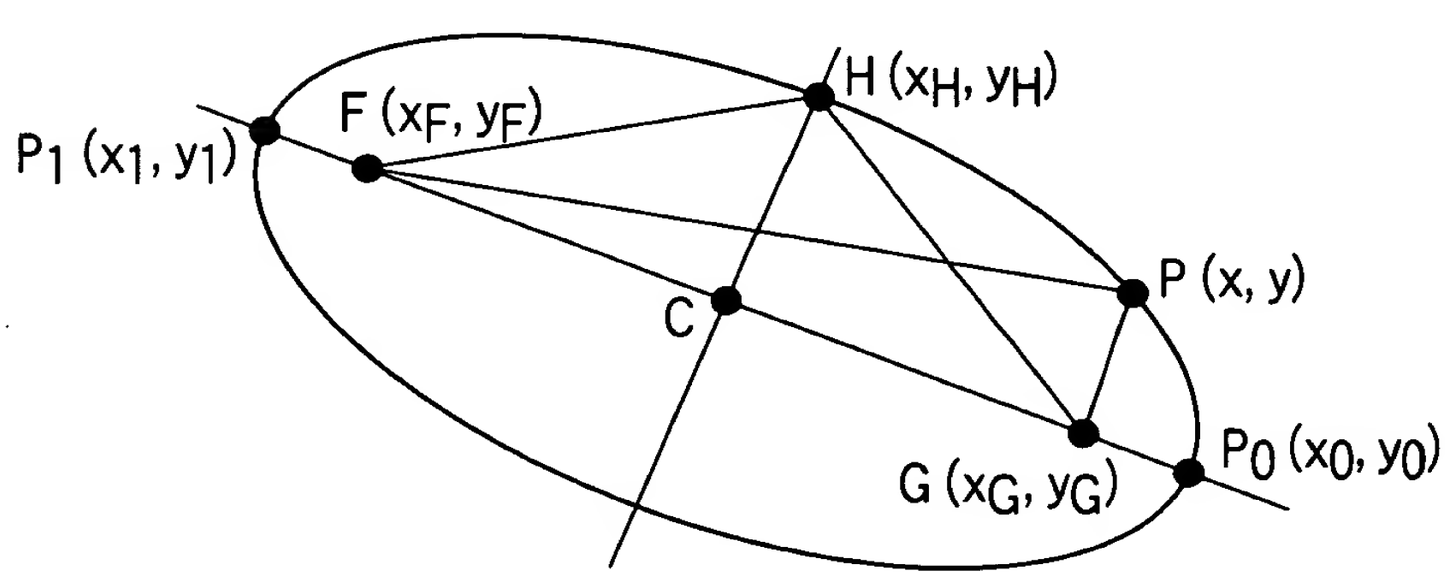


FIG. 41

OBJECT REGION DATA

ID NUMBER	400B
LEADING END FRAME NUMBER	401B
TRAILING END FRAME NUMBER	402B
POINTER FOR RELATED INFORMATION	403B
NUMBER OF APPROXIMATE FIGURES	404B
APPROXIMATE FIGURE DATA	405B

FIG. 42

APPROXIMATE FIGURE DATA

FIGURE TYPE ID	1300B
NUMBER OF REPRESENTATIVE POINTS	1301B
REPRESENTATIVE POINT X TRAJECTORY DATA (1X)	1302B
REPRESENTATIVE POINT Y TRAJECTORY DATA (1Y)	1303B
REPRESENTATIVE POINT Z TRAJECTORY DATA (1Z)	1304B
REPRESENTATIVE POINT X TRAJECTORY DATA (2X)	
REPRESENTATIVE POINT Y TRAJECTORY DATA (2Y)	
REPRESENTATIVE POINT Z TRAJECTORY DATA (2Z)	
⋮	
REPRESENTATIVE POINT X TRAJECTORY DATA (MX)	
REPRESENTATIVE POINT Y TRAJECTORY DATA (MY)	
REPRESENTATIVE POINT Z TRAJECTORY DATA (MZ)	

FIG. 43

REPRESENTATIVE POINT TRAJECTORY DATA

1403B

KNOT FRAME NUMBER	1400B
ORDER OF POLYNOMINAL	1401B
COEFFICIENT OF POLYNOMINAL (0TH ORDER)	1402B
COEFFICIENT OF POLYNOMINAL (1ST ORDER)	
⋮	
COEFFICIENT OF POLYNOMINAL (KTH ORDER)	
KNOT FRAME NUMBER	
ORDER OF POLYNOMINAL	
COEFFICIENT OF POLYNOMINAL (0TH ORDER)	
COEFFICIENT OF POLYNOMINAL (1ST ORDER)	
⋮	
COEFFICIENT OF POLYNOMINAL (K'TH ORDER)	
⋮	

FIG. 44

APPROXIMATE FIGURE DATA

FIGURE TYPE ID	1300B
NUMBER OF REPRESENTATIVE POINTS	1301B
REPRESENTATIVE POINT X TRAJECTORY DATA (1X)	1302B
REPRESENTATIVE POINT Y TRAJECTORY DATA (1Y)	1303B
REPRESENTATIVE POINT X TRAJECTORY DATA (2X)	
REPRESENTATIVE POINT Y TRAJECTORY DATA (2Y)	
⋮	
REPRESENTATIVE POINT X TRAJECTORY DATA (MX)	
REPRESENTATIVE POINT Y TRAJECTORY DATA (MY)	
DEPTH INFORMATION	1306B

FIG. 45

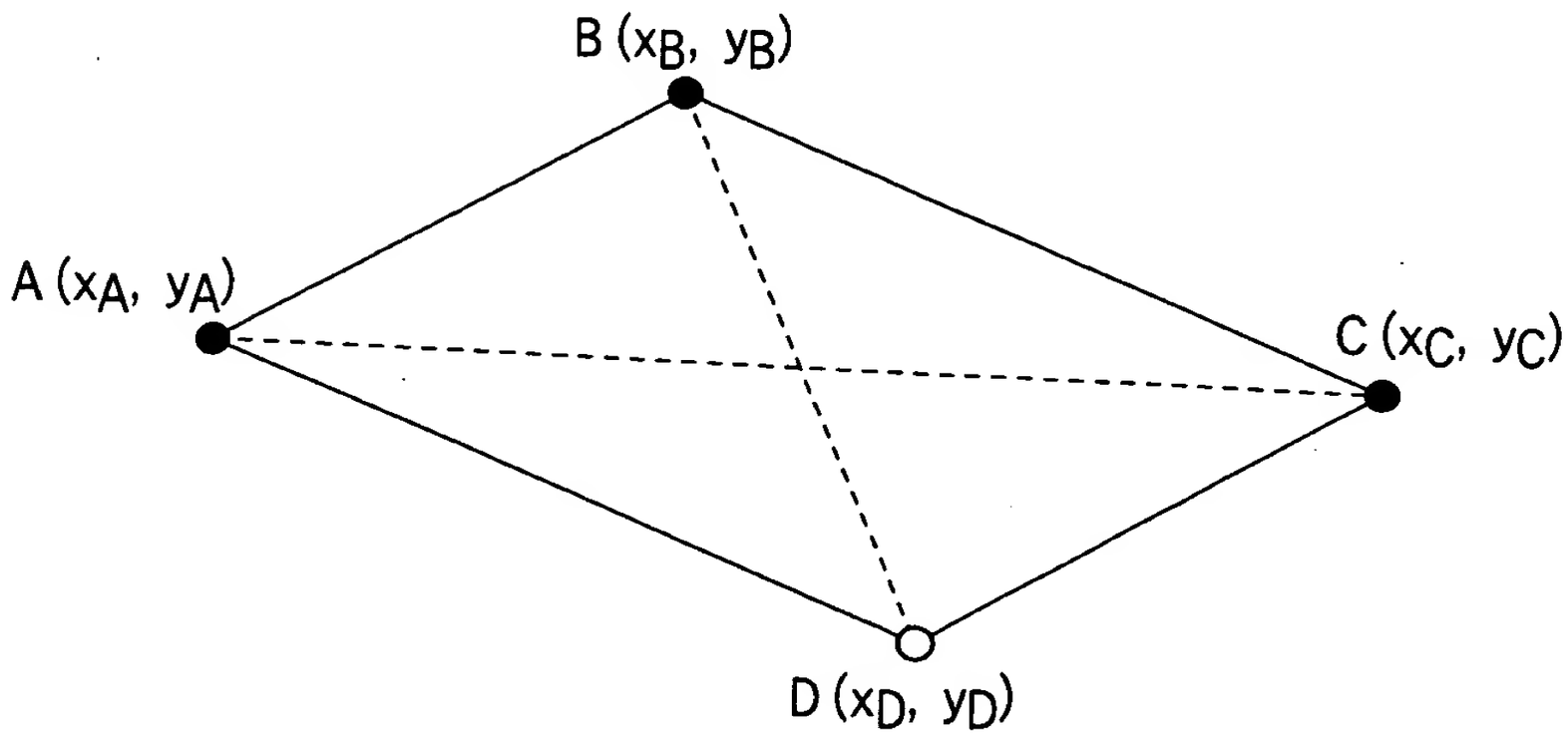


FIG. 46

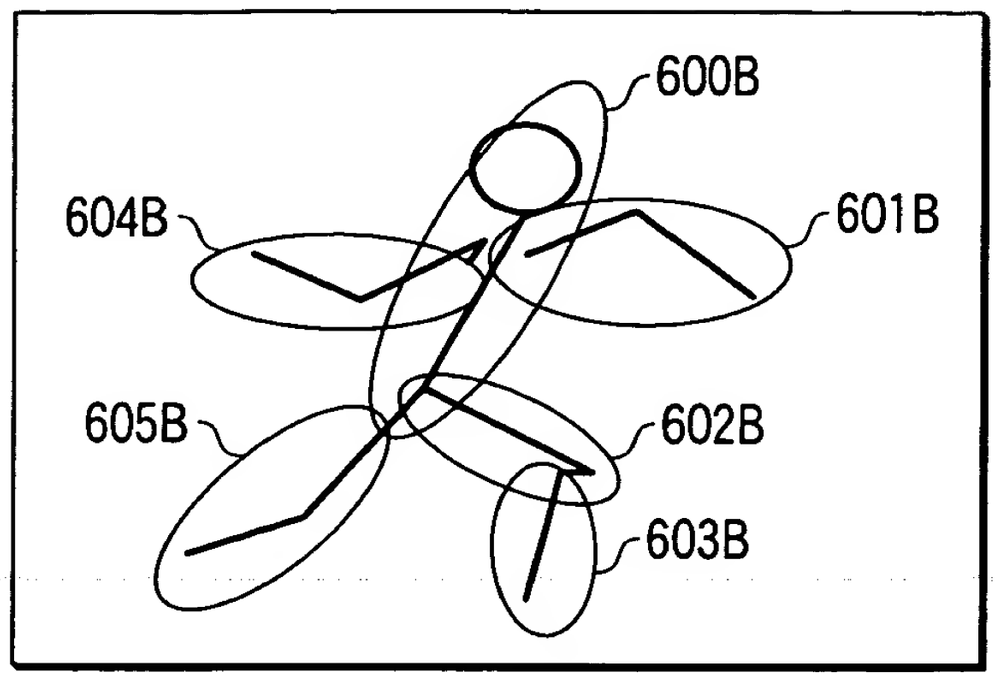
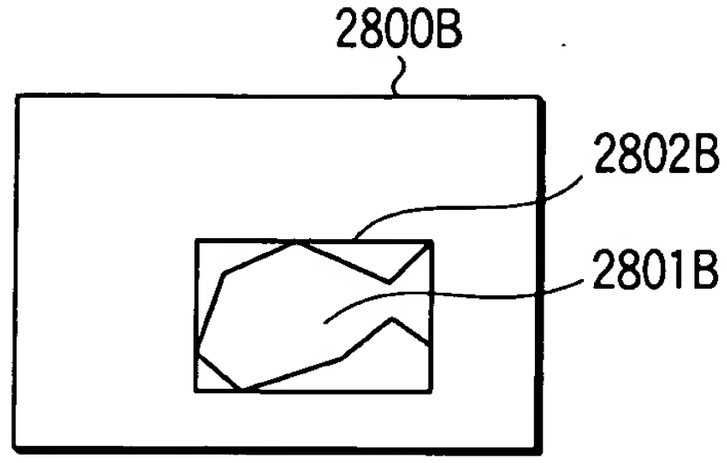


FIG. 47

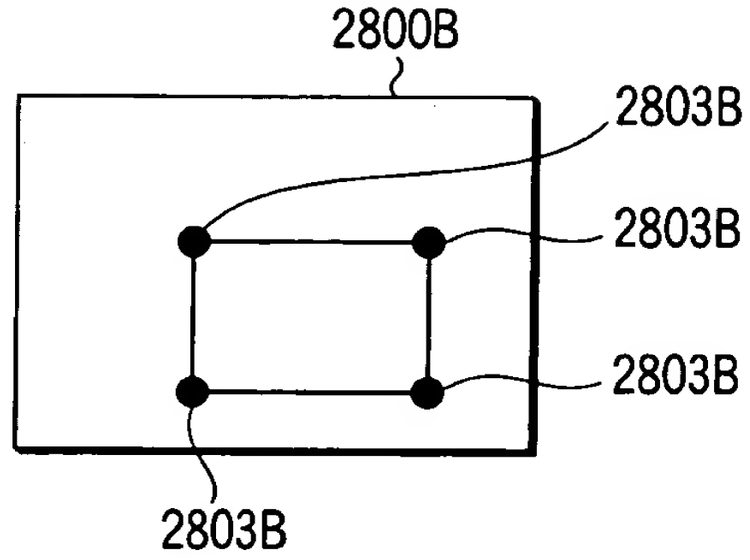
OBJECT REGION DATA

ID NUMBER	400B
LEADING END FRAME NUMBER	401B
TRAILING END FRAME NUMBER	402B
POINTER FOR RELATED INFORMATION	403B
NUMBER OF APPROXIMATE FIGURES	404B
APPROXIMATE FIGURE DATA (1)	405B
APPROXIMATE FIGURE DATA (2)	⋮
⋮	
APPROXIMATE FIGURE DATA (L)	

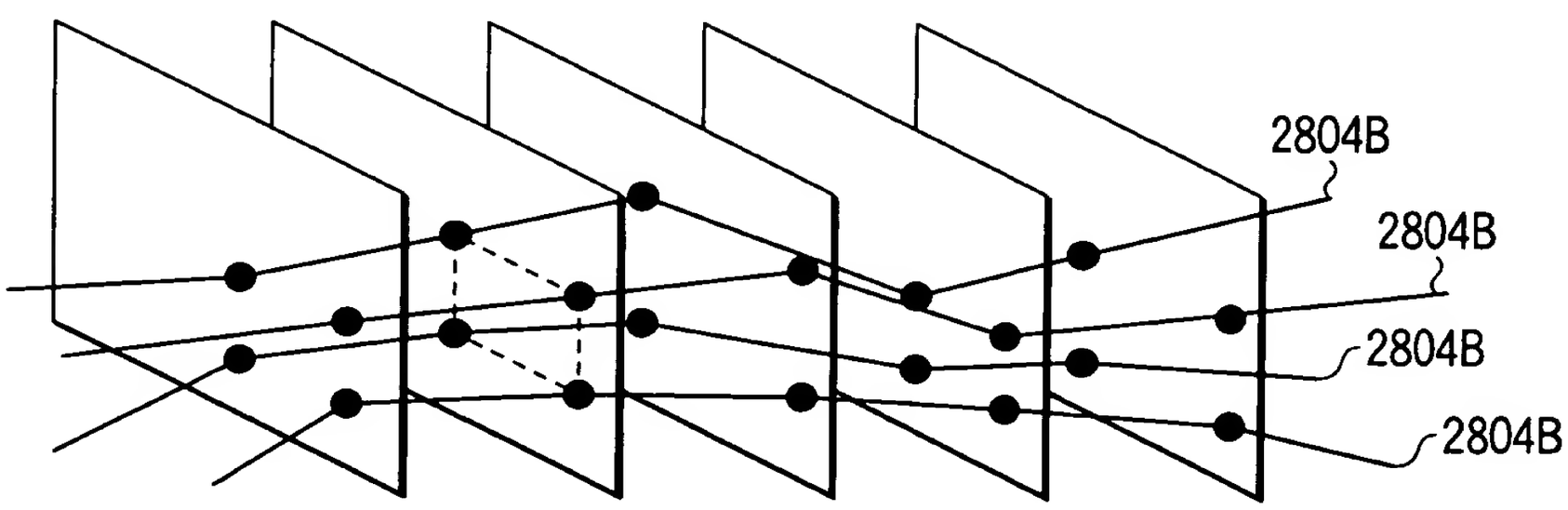
FIG. 48



F I G. 49A



F I G. 49B



F I G. 49C

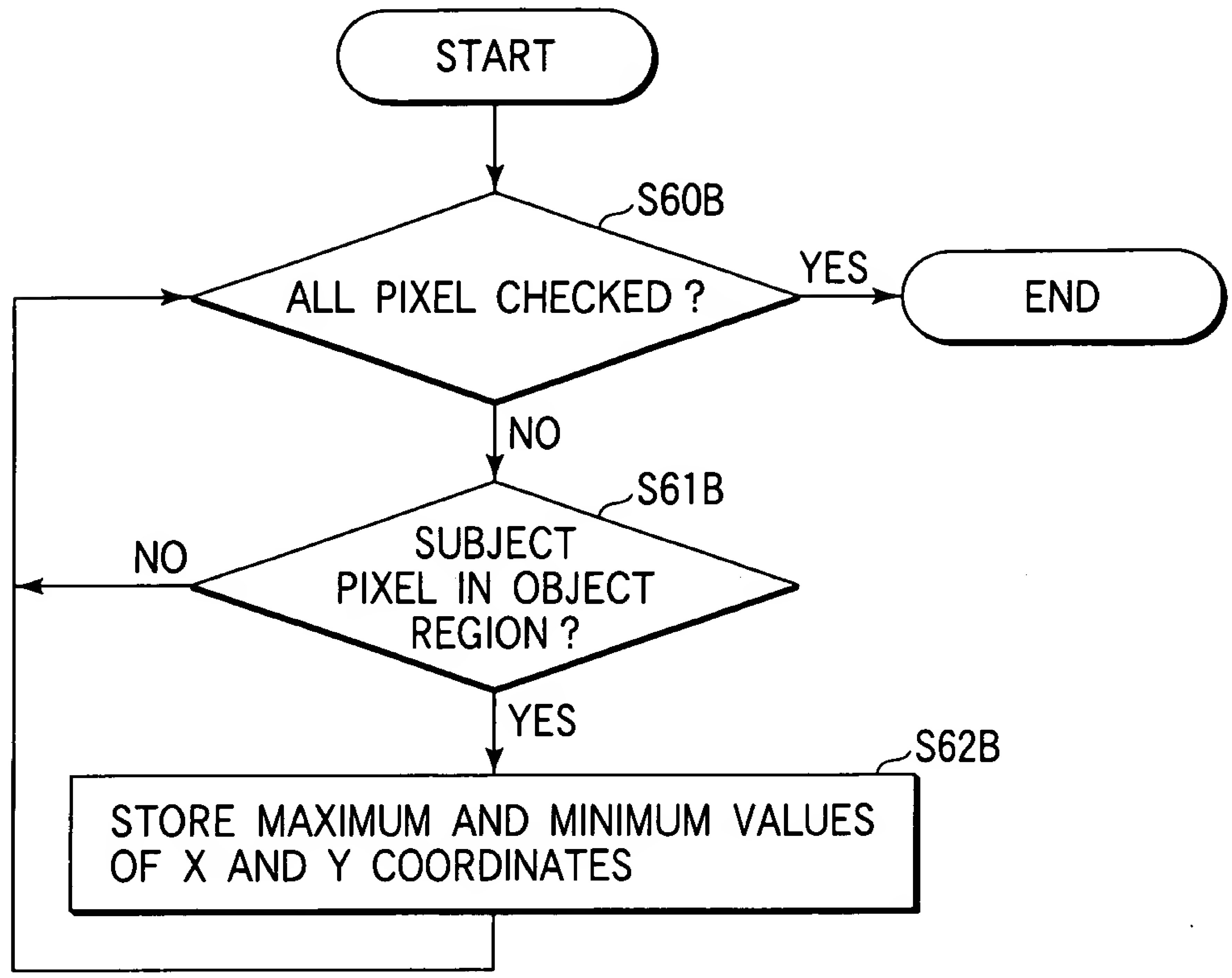


FIG. 50

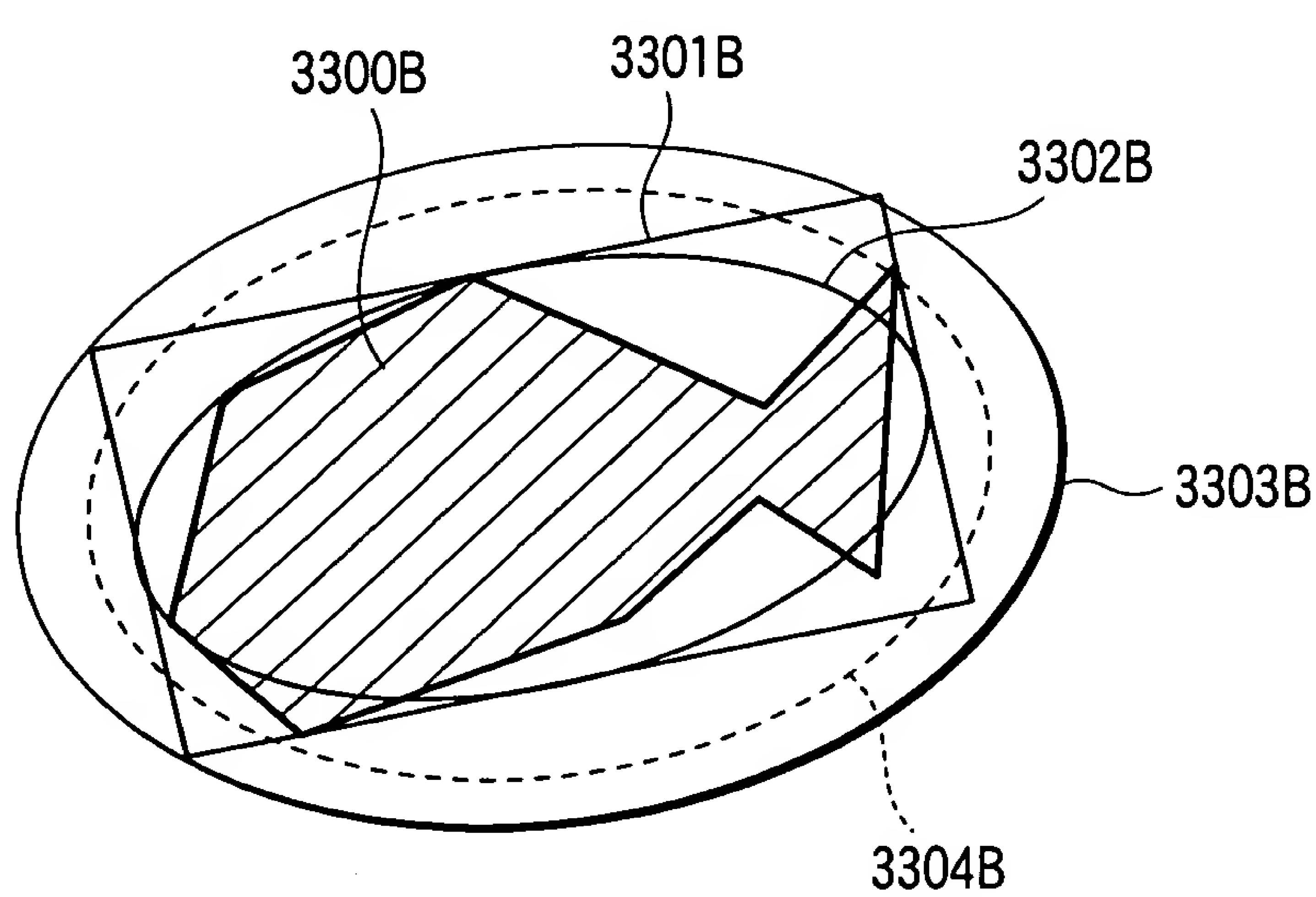


FIG. 51

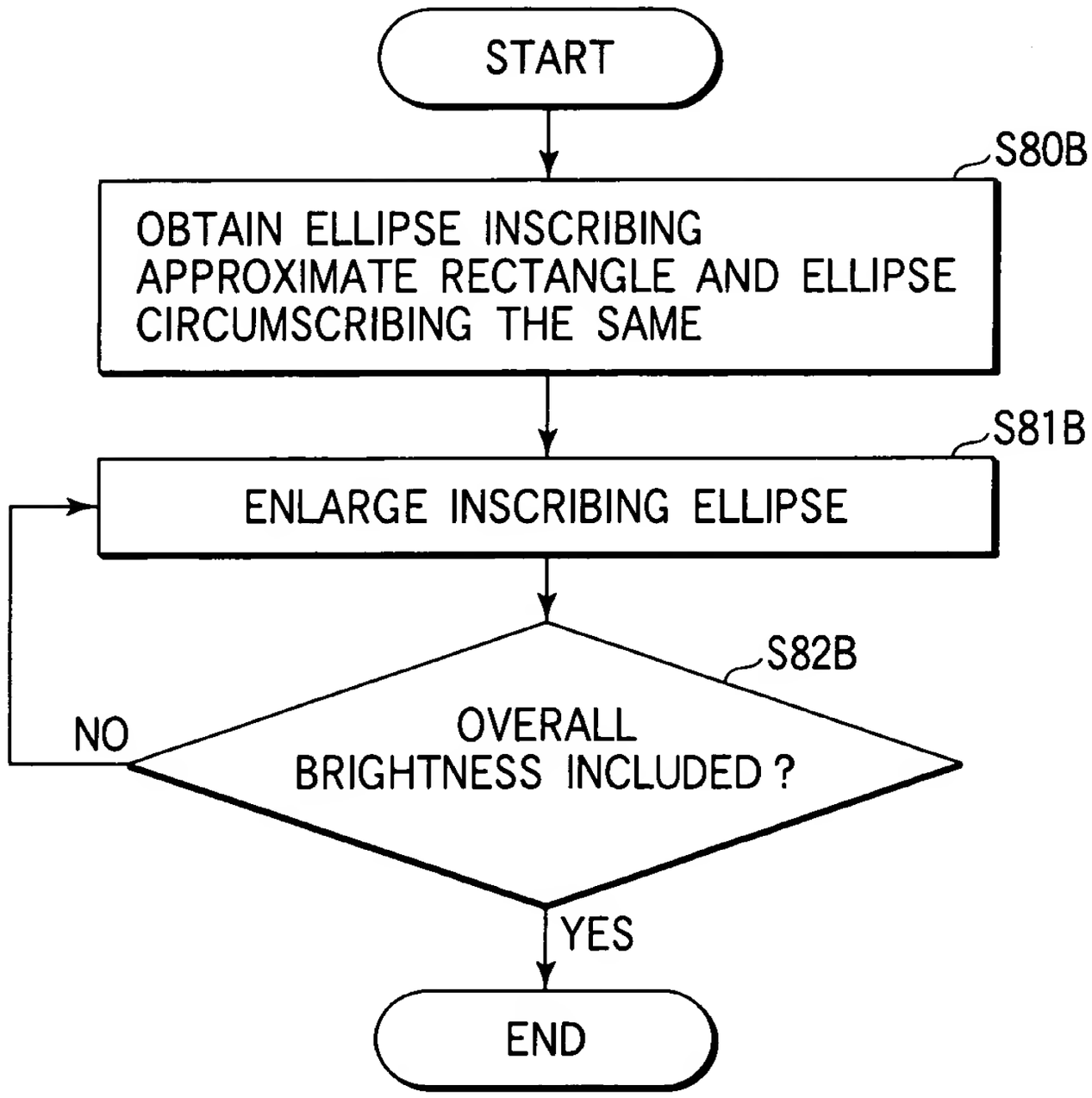

START
S80B
OBTAIN ELLIPSE INSCRIBING APPROXIMATE RECTANGLE AND ELLIPSE CIRCUMSCRIBING THE SAME
S81B
ENLARGE INSCRIBING ELLIPSE
S82B
OVERALL BRIGHTNESS INCLUDED ?
NO
YES
END

FIG. 52

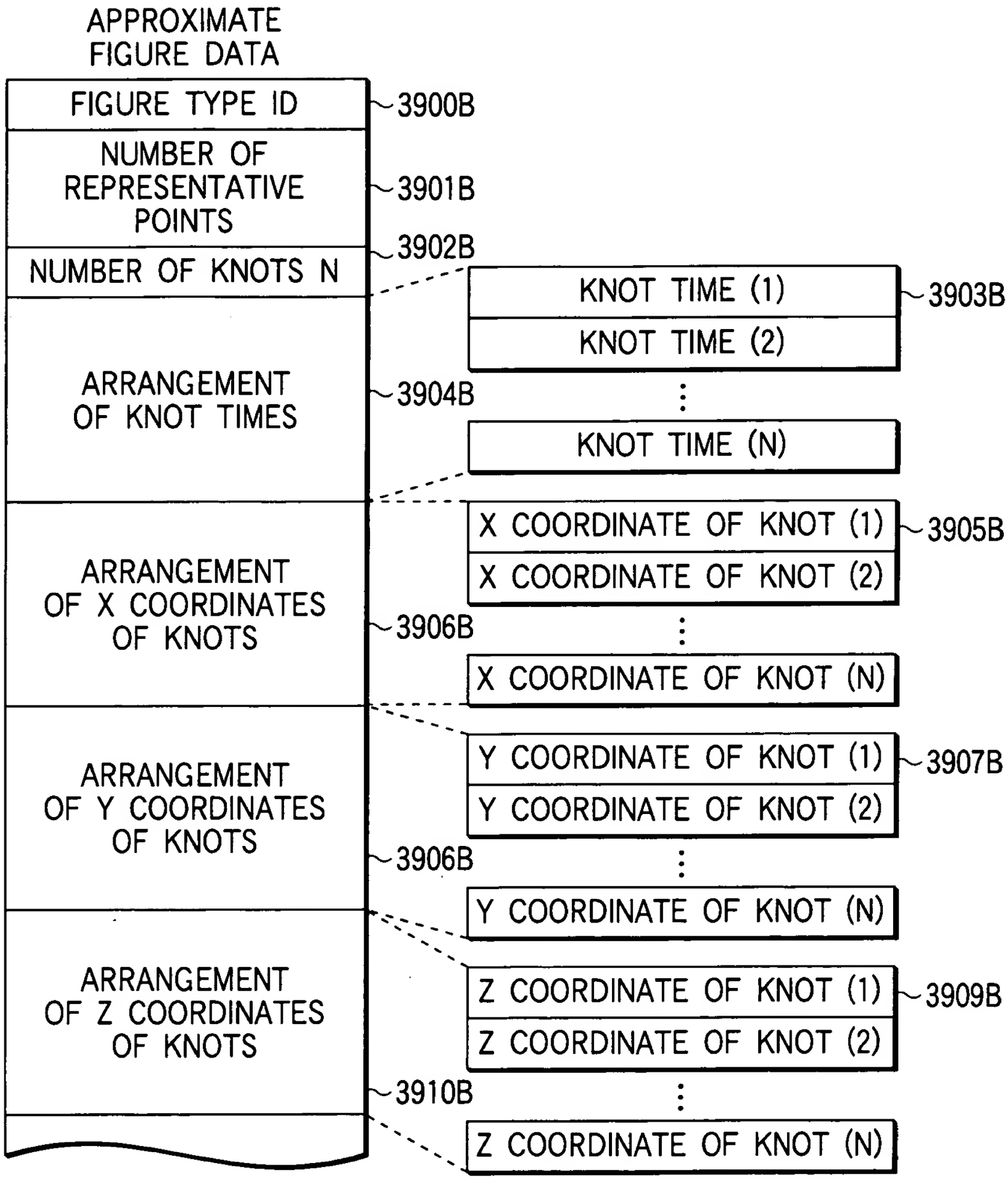

APPROXIMATE FIGURE DATA
FIGURE TYPE ID
3900B
NUMBER OF REPRESENTATIVE POINTS
3901B
NUMBER OF KNOTS N
3902B
ARRANGEMENT OF KNOT TIMES
3904B
KNOT TIME (1)
KNOT TIME (2)
KNOT TIME (N)
3903B
ARRANGEMENT OF X COORDINATES OF KNOTS
3906B
X COORDINATE OF KNOT (1)
X COORDINATE OF KNOT (2)
X COORDINATE OF KNOT (N)
3905B
ARRANGEMENT OF Y COORDINATES OF KNOTS
3906B
Y COORDINATE OF KNOT (1)
Y COORDINATE OF KNOT (2)
Y COORDINATE OF KNOT (N)
3907B
ARRANGEMENT OF Z COORDINATES OF KNOTS
3910B
Z COORDINATE OF KNOT (1)
Z COORDINATE OF KNOT (2)
Z COORDINATE OF KNOT (N)
3909B

FIG. 53

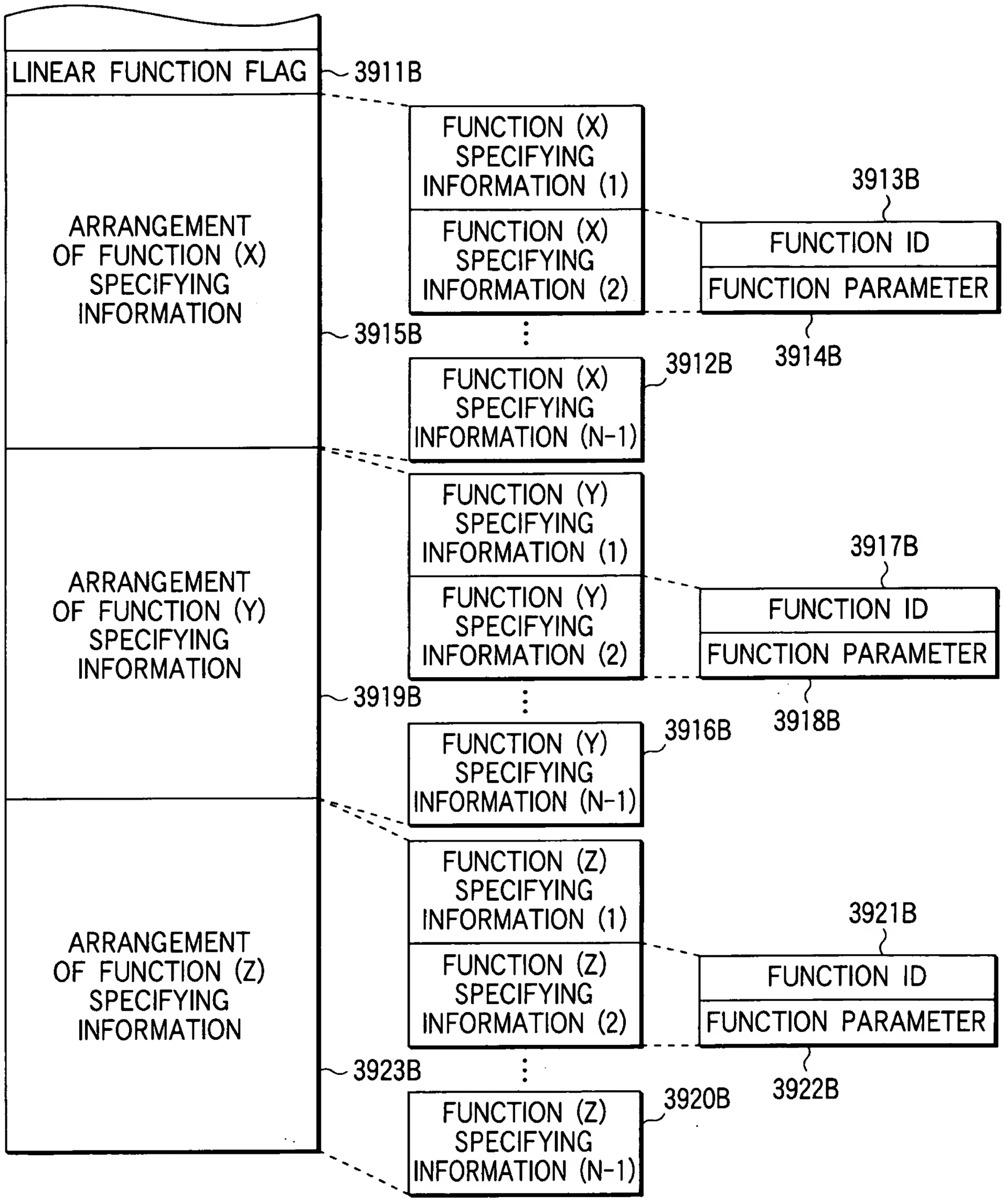

LINEAR FUNCTION FLAG
3911B
ARRANGEMENT OF FUNCTION (X) SPECIFYING INFORMATION
ARRANGEMENT OF FUNCTION (Y) SPECIFYING INFORMATION
ARRANGEMENT OF FUNCTION (Z) SPECIFYING INFORMATION
FUNCTION (X) SPECIFYING INFORMATION (1)
FUNCTION (X) SPECIFYING INFORMATION (2)
3913B
FUNCTION ID
FUNCTION PARAMETER
3914B
3915B
FUNCTION (X) SPECIFYING INFORMATION (N-1)
3912B
FUNCTION (Y) SPECIFYING INFORMATION (1)
FUNCTION (Y) SPECIFYING INFORMATION (2)
3917B
FUNCTION ID
FUNCTION PARAMETER
3918B
3919B
FUNCTION (Y) SPECIFYING INFORMATION (N-1)
3916B
FUNCTION (Z) SPECIFYING INFORMATION (1)
FUNCTION (Z) SPECIFYING INFORMATION (2)
3921B
FUNCTION ID
FUNCTION PARAMETER
3922B
3923B
FUNCTION (Z) SPECIFYING INFORMATION (N-1)
3920B

FIG. 54

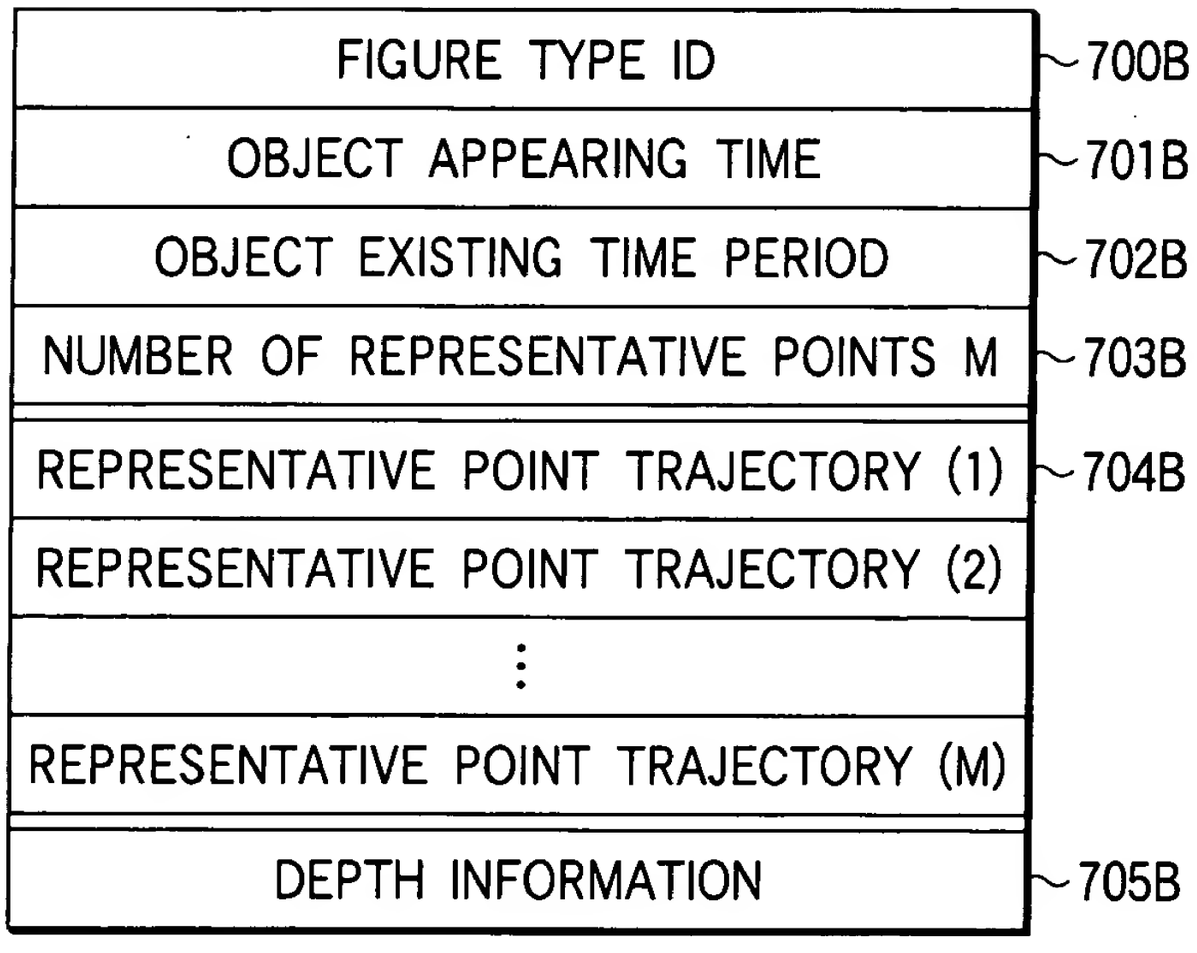


FIG. 55

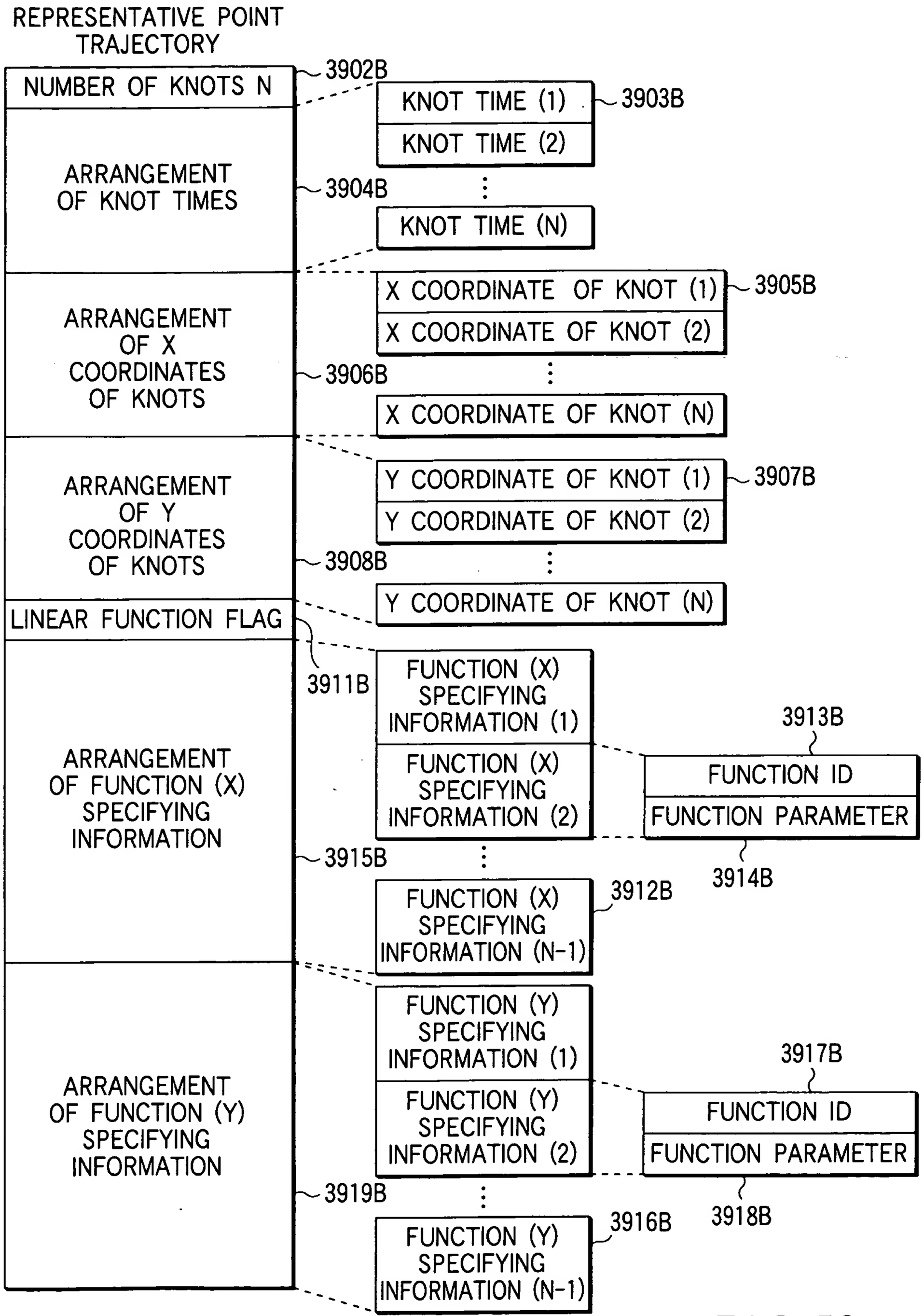


FIG. 56

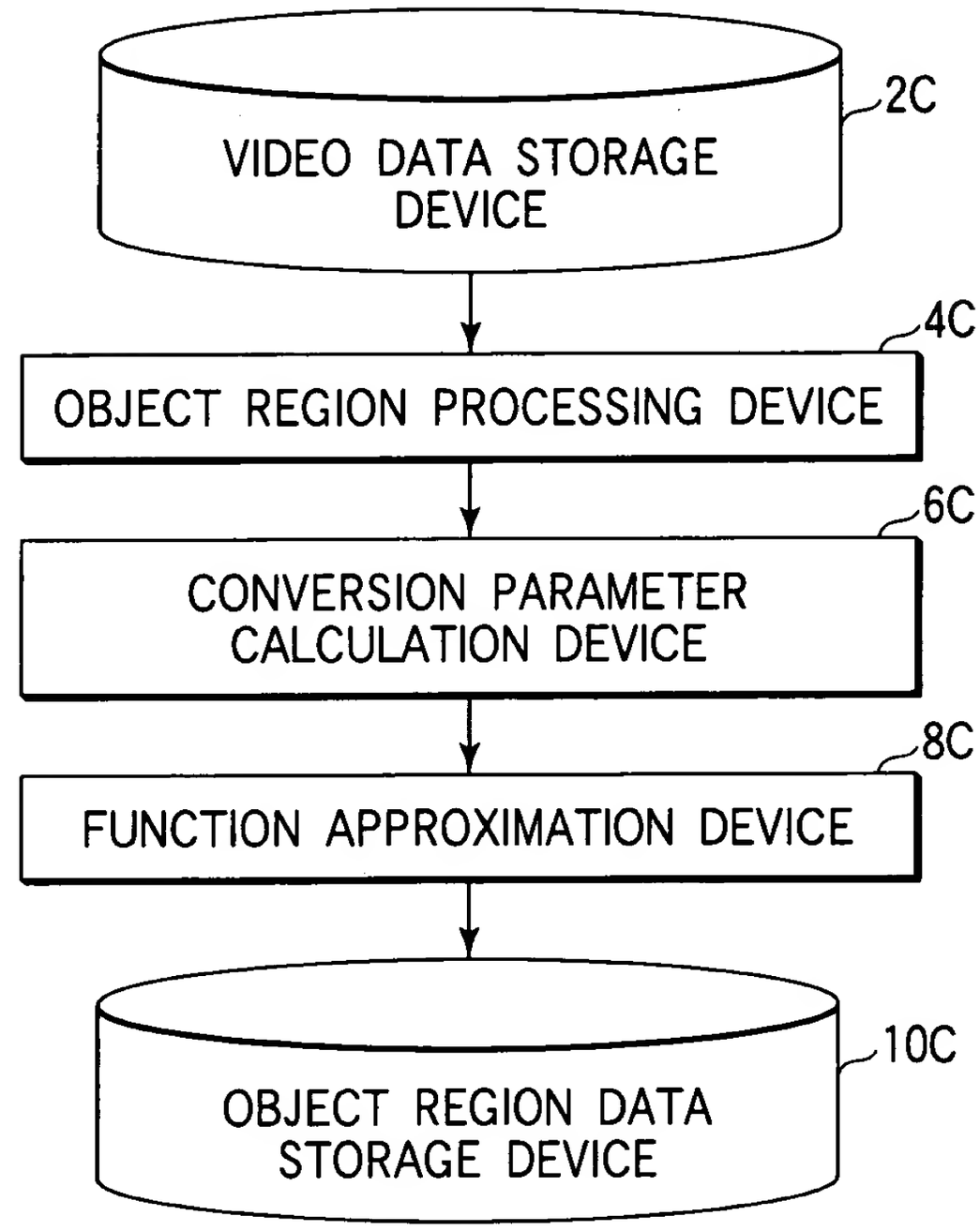

VIDEO DATA STORAGE DEVICE
2C
OBJECT REGION PROCESSING DEVICE
4C
CONVERSION PARAMETER CALCULATION DEVICE
6C
FUNCTION APPROXIMATION DEVICE
8C
OBJECT REGION DATA STORAGE DEVICE
10C

FIG. 57

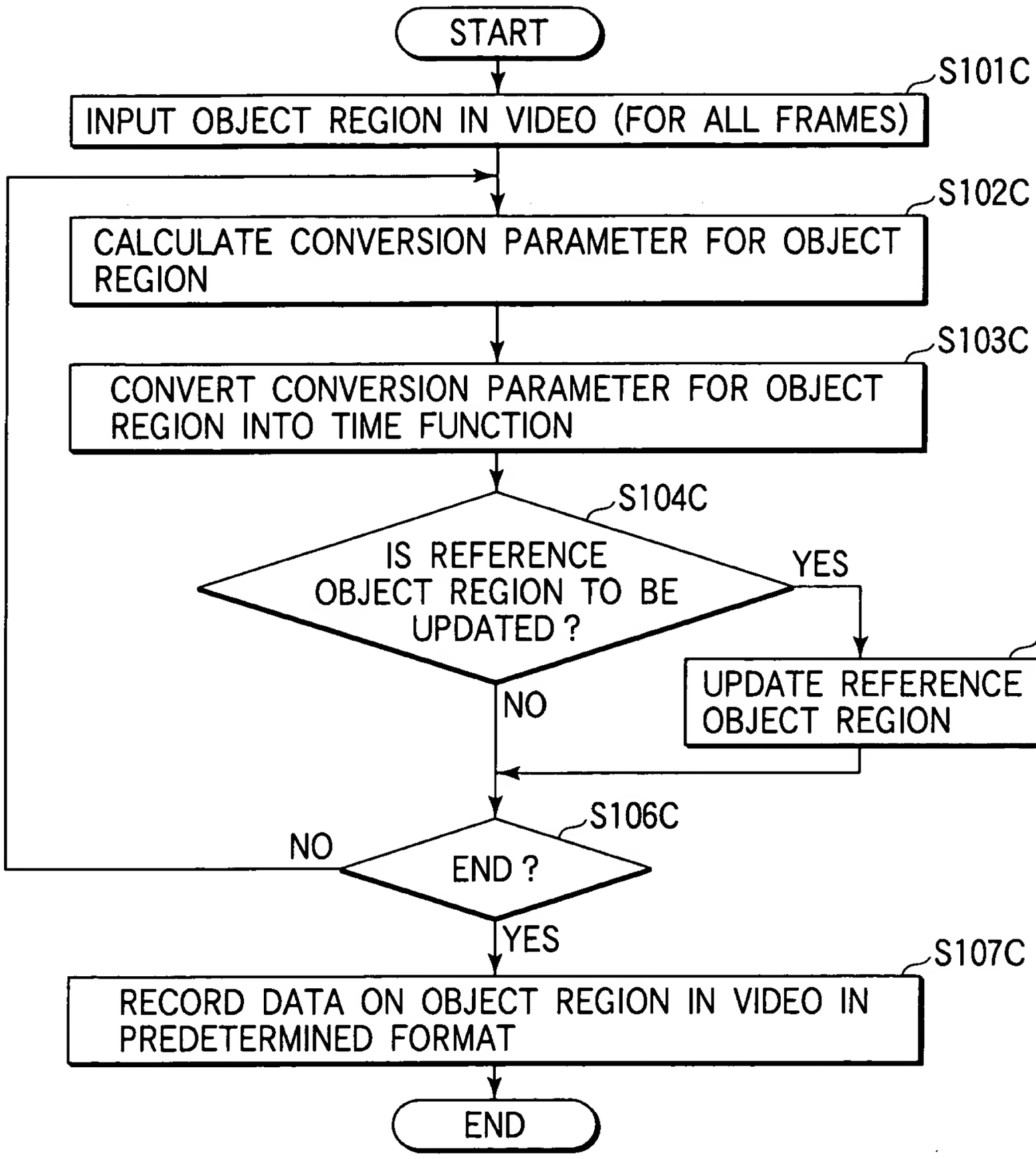

START
S101C
INPUT OBJECT REGION IN VIDEO (FOR ALL FRAMES)
S102C
CALCULATE CONVERSION PARAMETER FOR OBJECT REGION
S103C
CONVERT CONVERSION PARAMETER FOR OBJECT REGION INTO TIME FUNCTION
S104C
IS REFERENCE OBJECT REGION TO BE UPDATED ?
YES
NO
S105C
UPDATE REFERENCE OBJECT REGION
S106C
END ?
NO
YES
S107C
RECORD DATA ON OBJECT REGION IN VIDEO IN PREDETERMINED FORMAT
END

FIG. 58

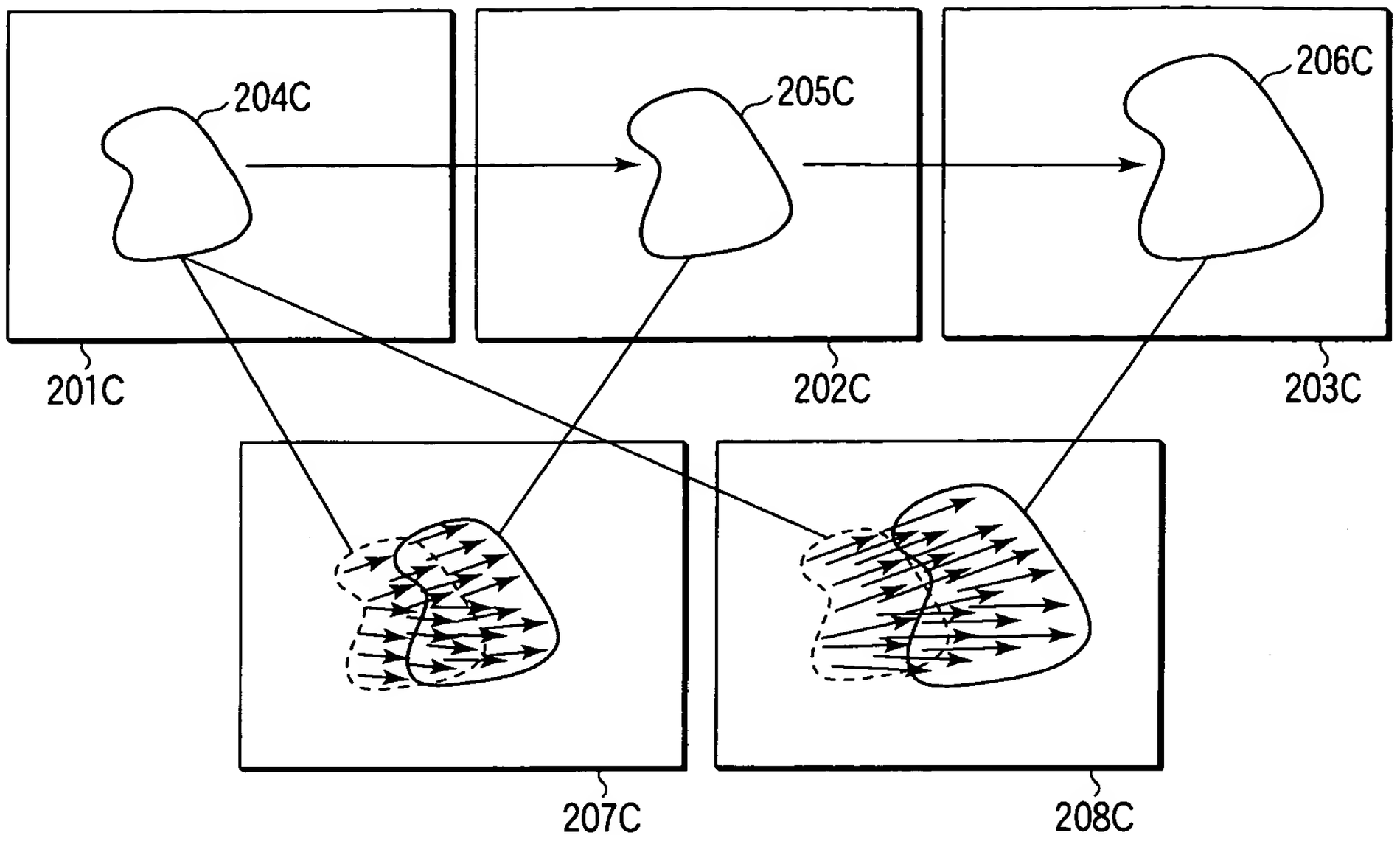


FIG. 59

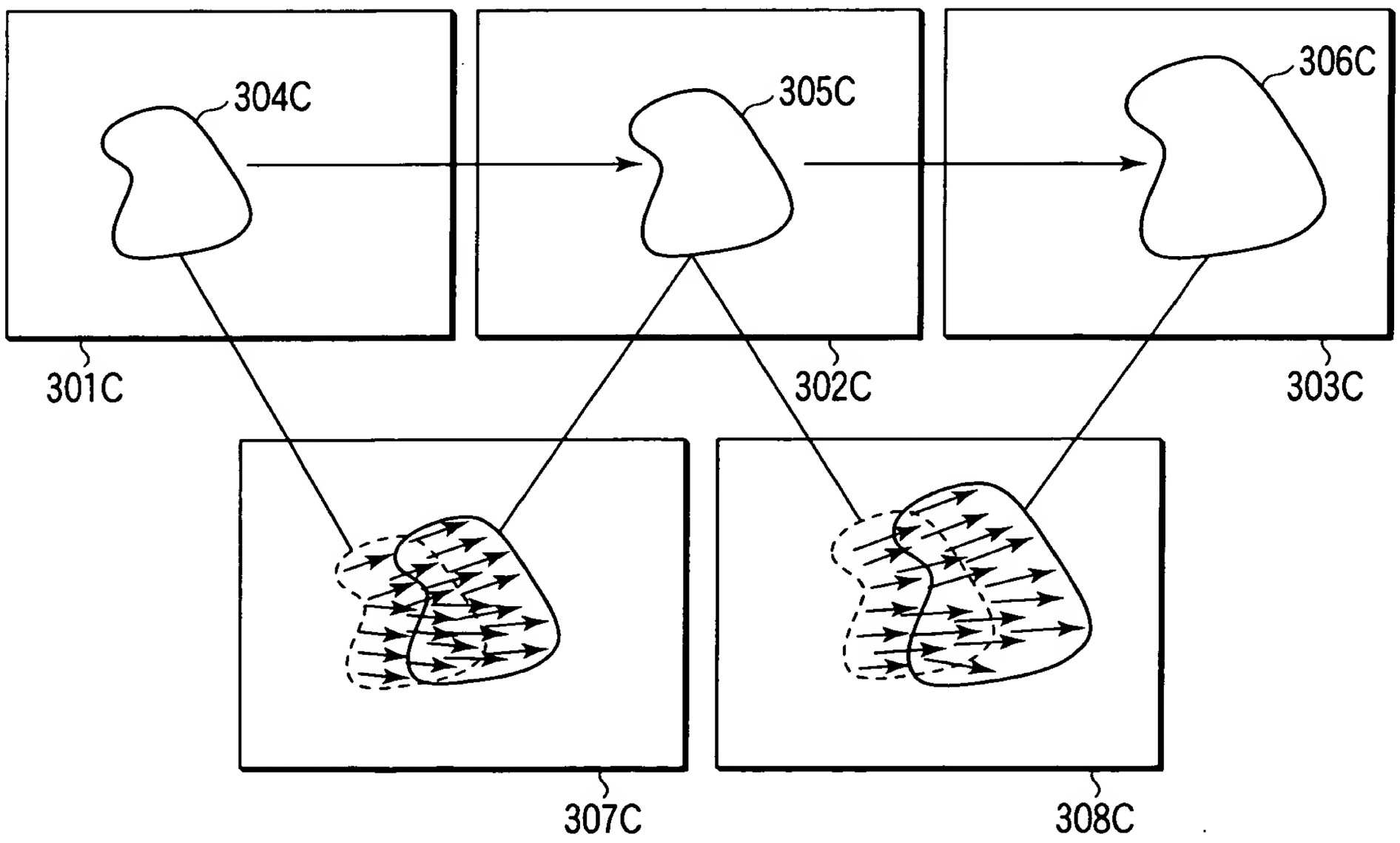


FIG. 60

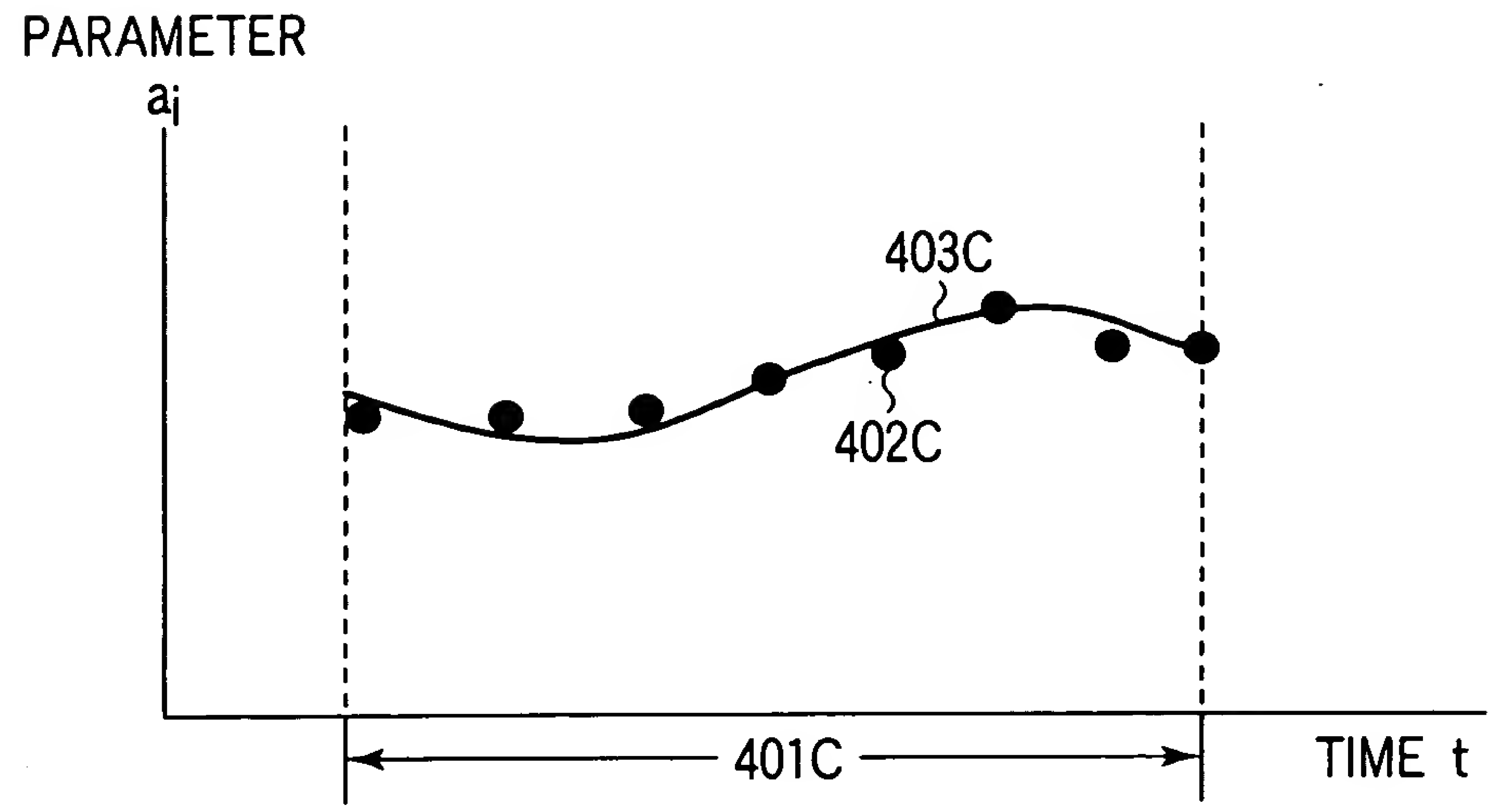


FIG. 61

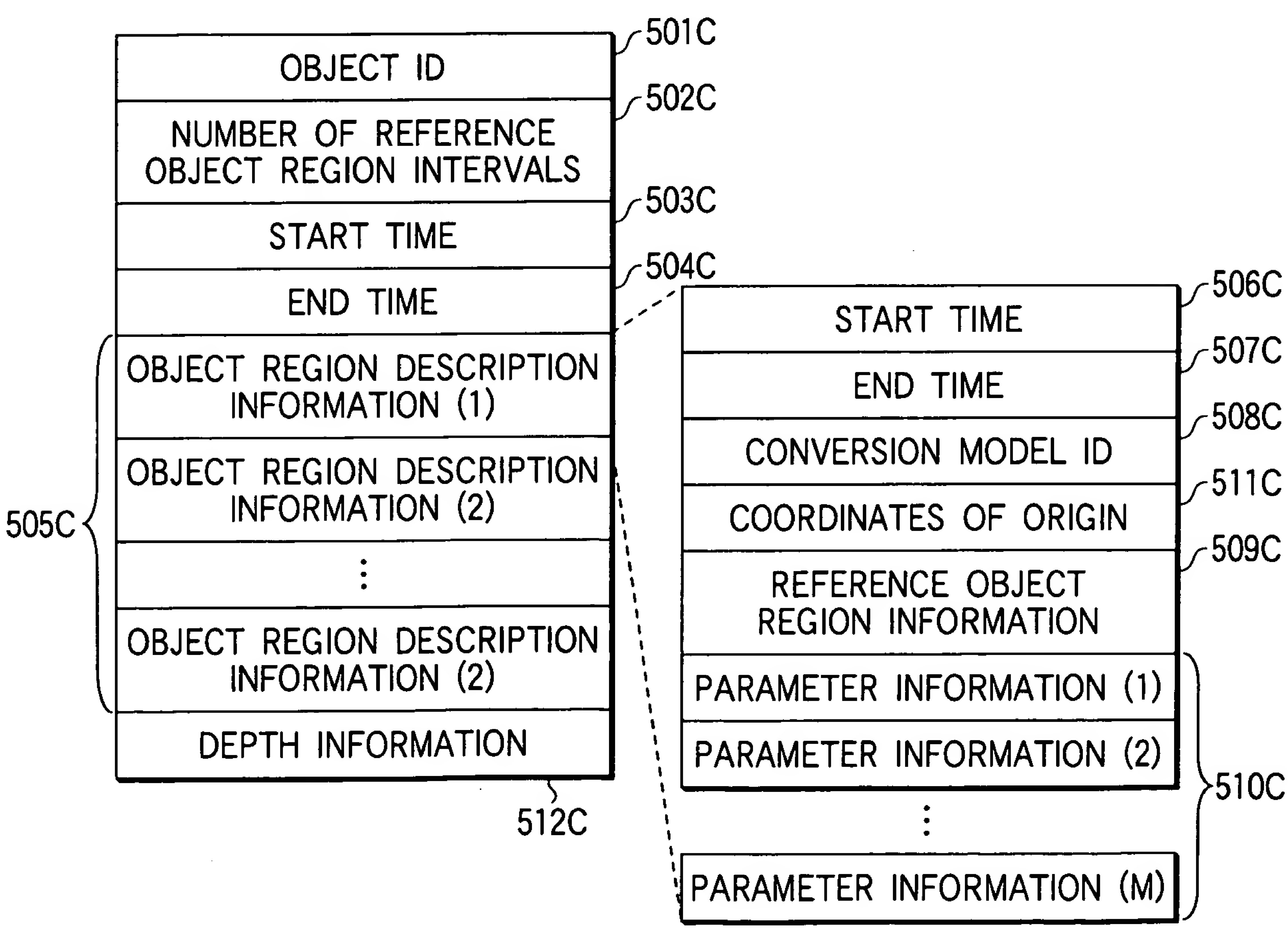


FIG. 62

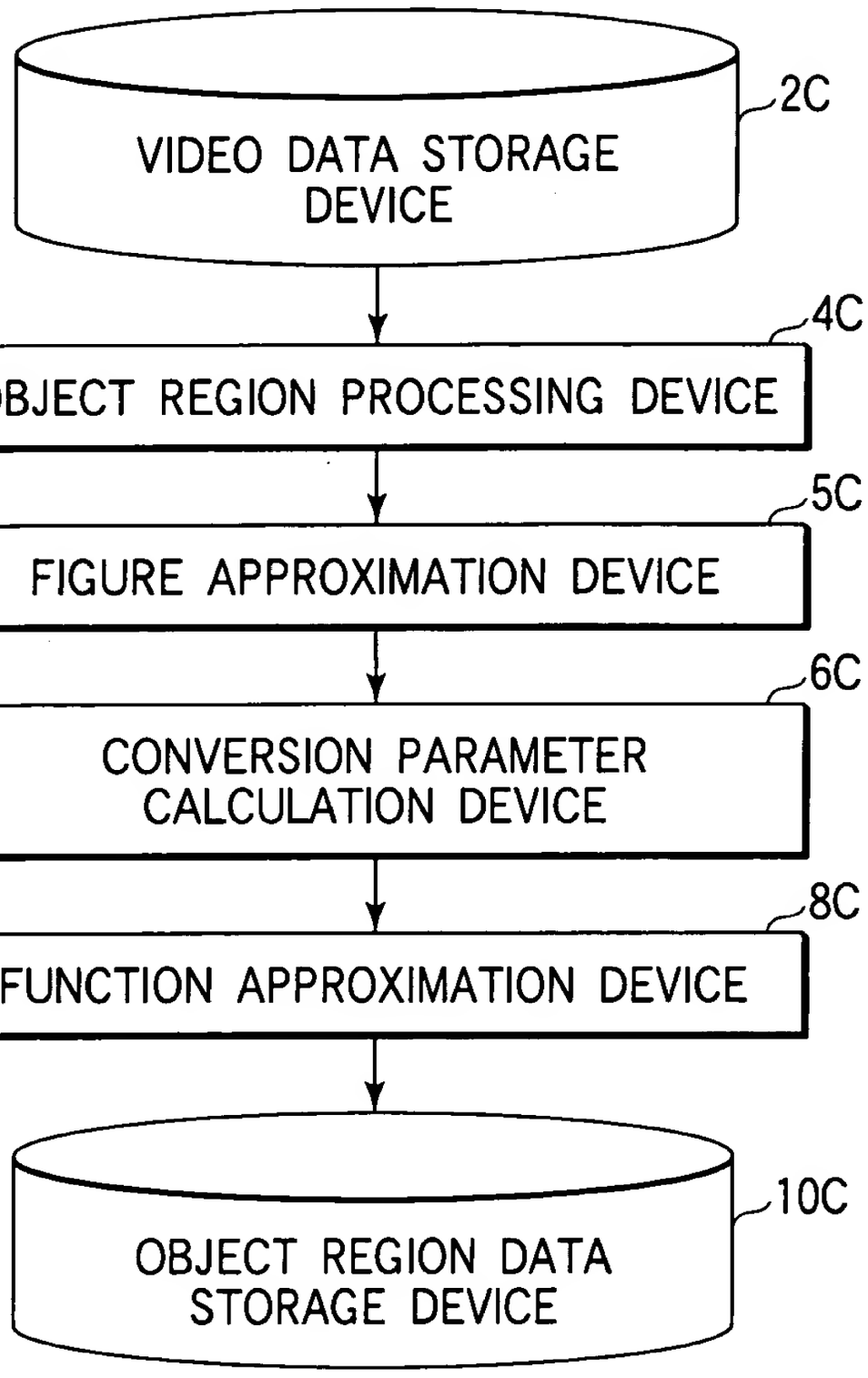

VIDEO DATA STORAGE DEVICE
2C
OBJECT REGION PROCESSING DEVICE
4C
FIGURE APPROXIMATION DEVICE
5C
CONVERSION PARAMETER CALCULATION DEVICE
6C
FUNCTION APPROXIMATION DEVICE
8C
OBJECT REGION DATA STORAGE DEVICE
10C

FIG. 63

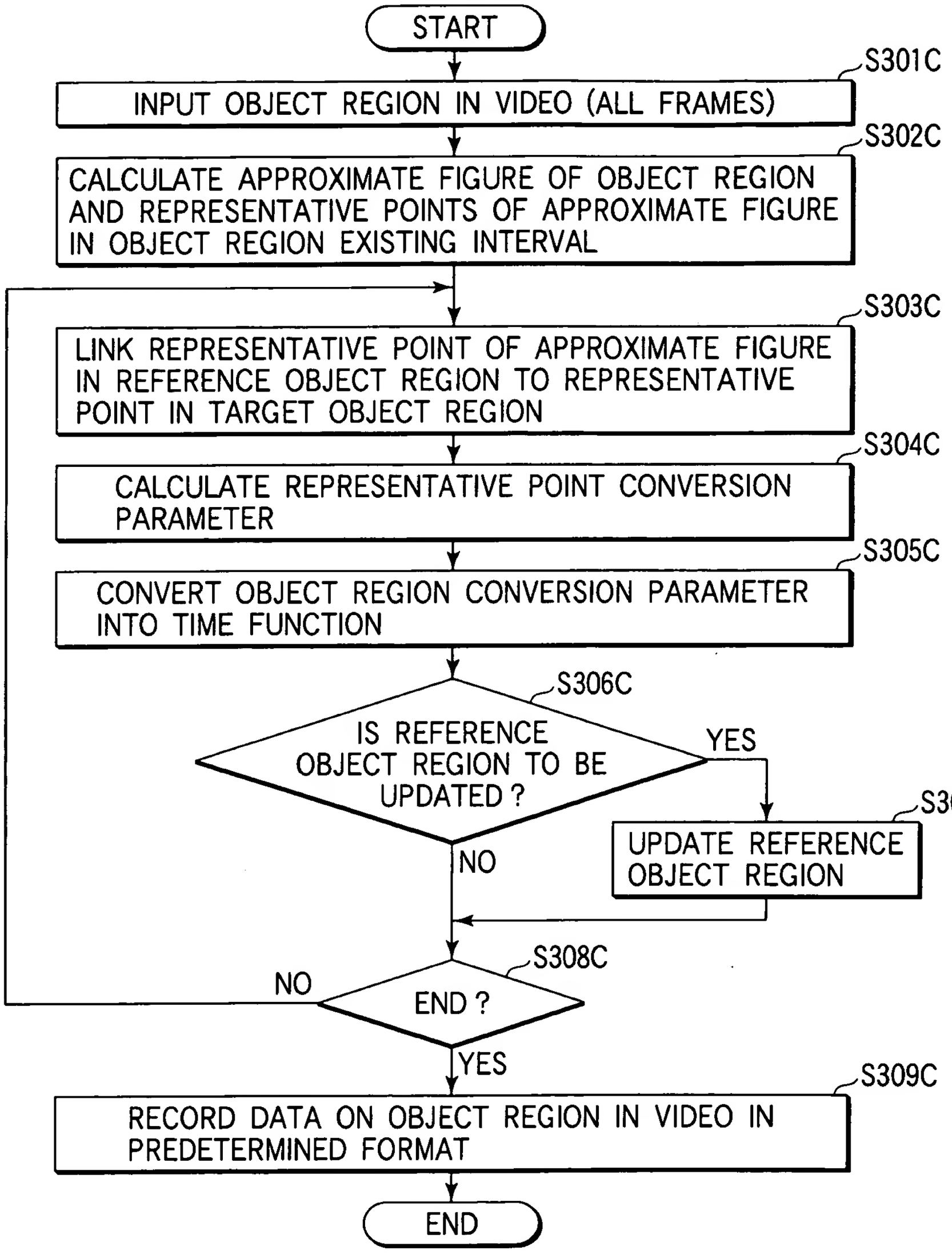

START
S301C
INPUT OBJECT REGION IN VIDEO (ALL FRAMES)
S302C
CALCULATE APPROXIMATE FIGURE OF OBJECT REGION AND REPRESENTATIVE POINTS OF APPROXIMATE FIGURE IN OBJECT REGION EXISTING INTERVAL
S303C
LINK REPRESENTATIVE POINT OF APPROXIMATE FIGURE IN REFERENCE OBJECT REGION TO REPRESENTATIVE POINT IN TARGET OBJECT REGION
S304C
CALCULATE REPRESENTATIVE POINT CONVERSION PARAMETER
S305C
CONVERT OBJECT REGION CONVERSION PARAMETER INTO TIME FUNCTION
S306C
IS REFERENCE OBJECT REGION TO BE UPDATED ?
YES
NO
S307C
UPDATE REFERENCE OBJECT REGION
S308C
END ?
NO
YES
S309C
RECORD DATA ON OBJECT REGION IN VIDEO IN PREDETERMINED FORMAT
END

FIG. 64

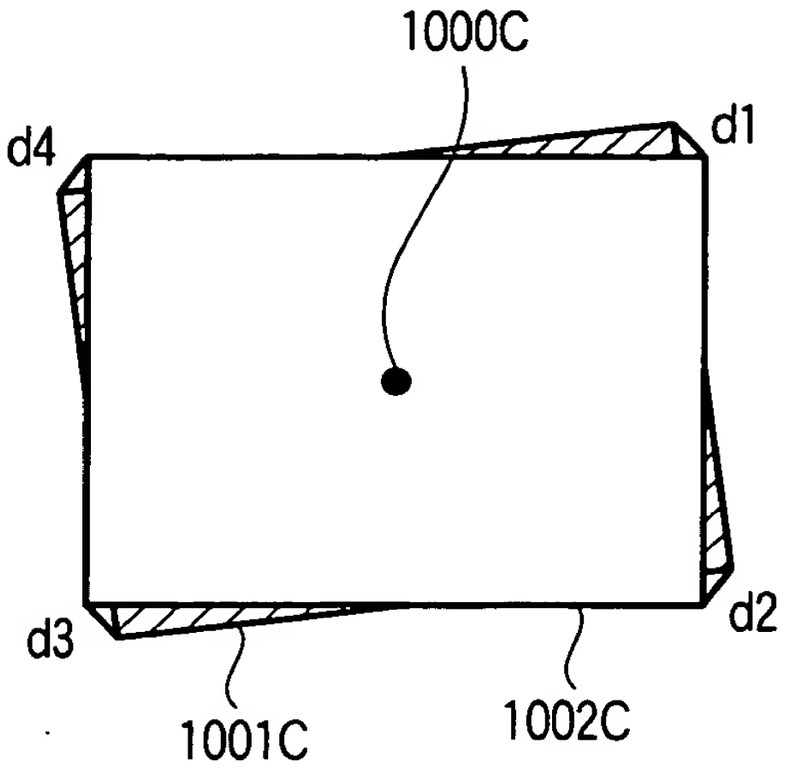


FIG. 65

MOVEMENT MODEL / APPROXIMATE FIGURE	ENLARGEMENT/ REDUCTION	ROTATION	PARALLEL TRANSLATION	4-PARAMETER CONVERSION	AFFINE CONVERSION	PROJECTION CONVERSION	PARABOLIC CONVERSION
RECTANGLE, ELLIPSE (WITHOUT GRADIENT)	○	×	○	×	×	×	×
RECTANGLE, ELLIPSE (WITH GRADIENT)	○	○	○	○	×	×	×
PARALLELOGRAM	○	○	○	○	○	×	×
POLYGON (NUMBER OF VERTEXES > 11)	○	○	○	○	○	○	○

FIG. 66

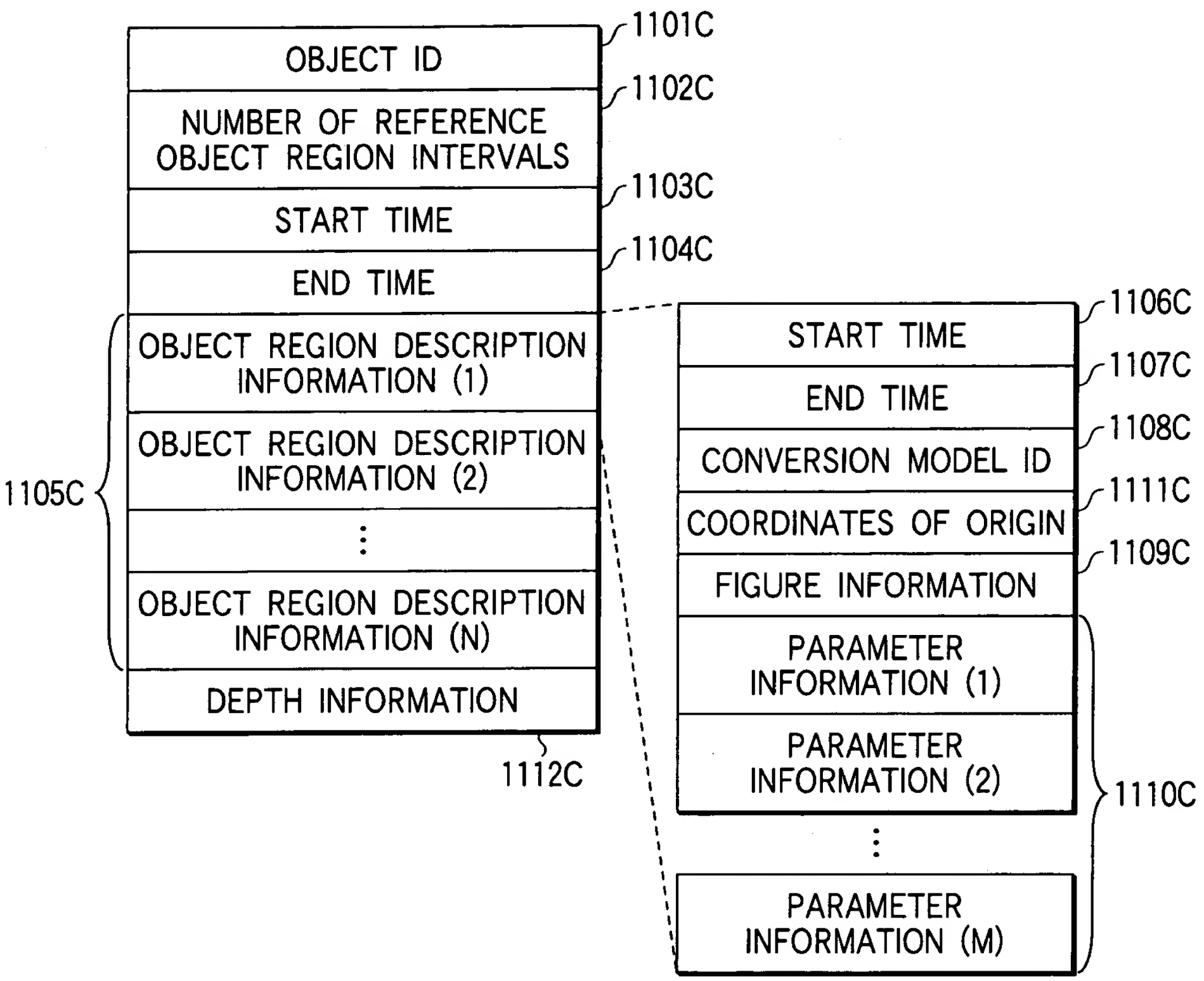

1101C
OBJECT ID
1102C
NUMBER OF REFERENCE OBJECT REGION INTERVALS
1103C
START TIME
1104C
END TIME
1105C
OBJECT REGION DESCRIPTION INFORMATION (1)
OBJECT REGION DESCRIPTION INFORMATION (2)
OBJECT REGION DESCRIPTION INFORMATION (N)
DEPTH INFORMATION
1112C
1106C
START TIME
1107C
END TIME
1108C
CONVERSION MODEL ID
1111C
COORDINATES OF ORIGIN
1109C
FIGURE INFORMATION
PARAMETER INFORMATION (1)
PARAMETER INFORMATION (2)
PARAMETER INFORMATION (M)
1110C

FIG. 67

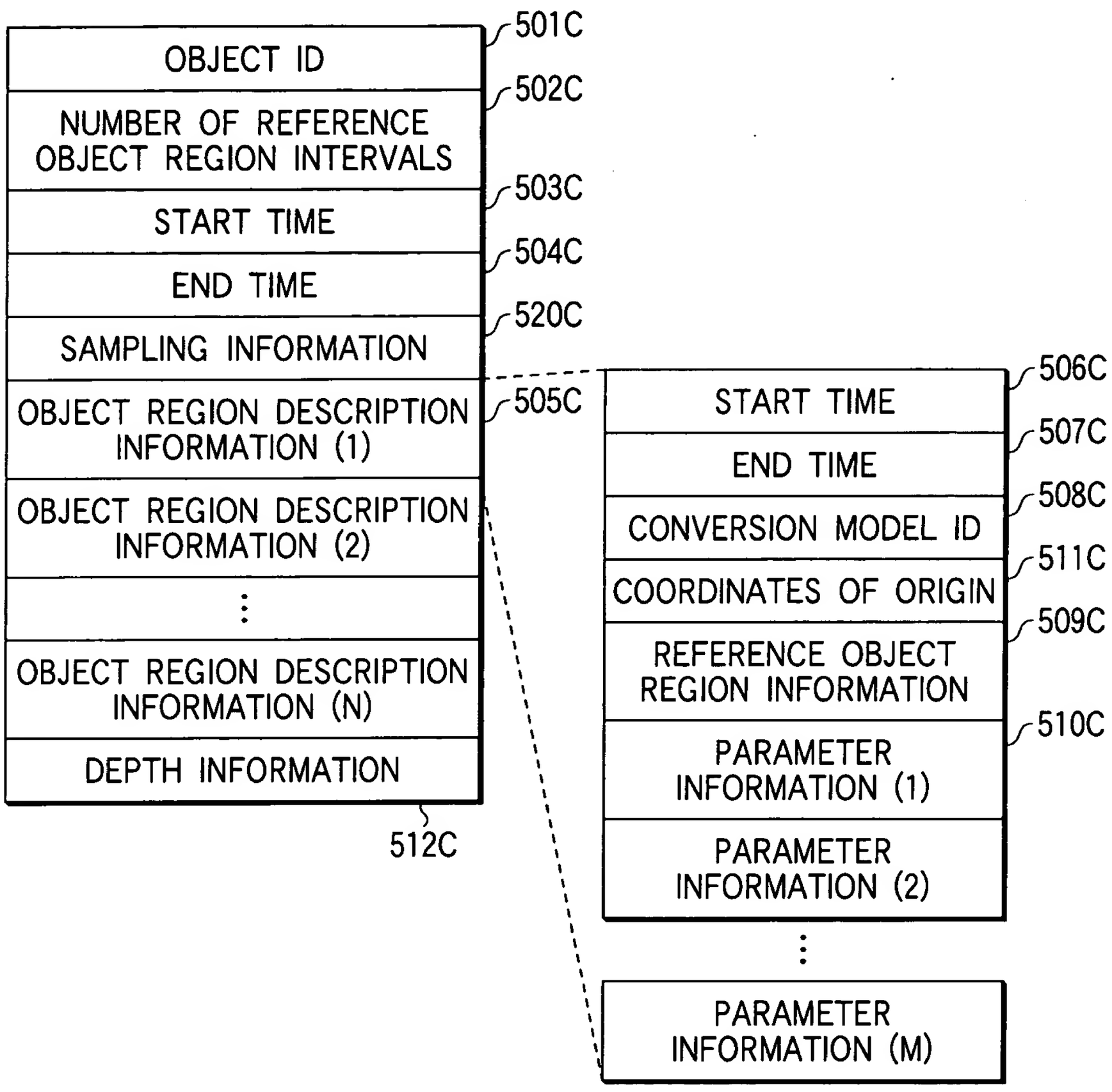


FIG. 68

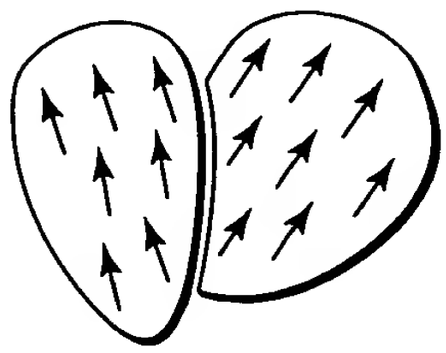


FIG. 69

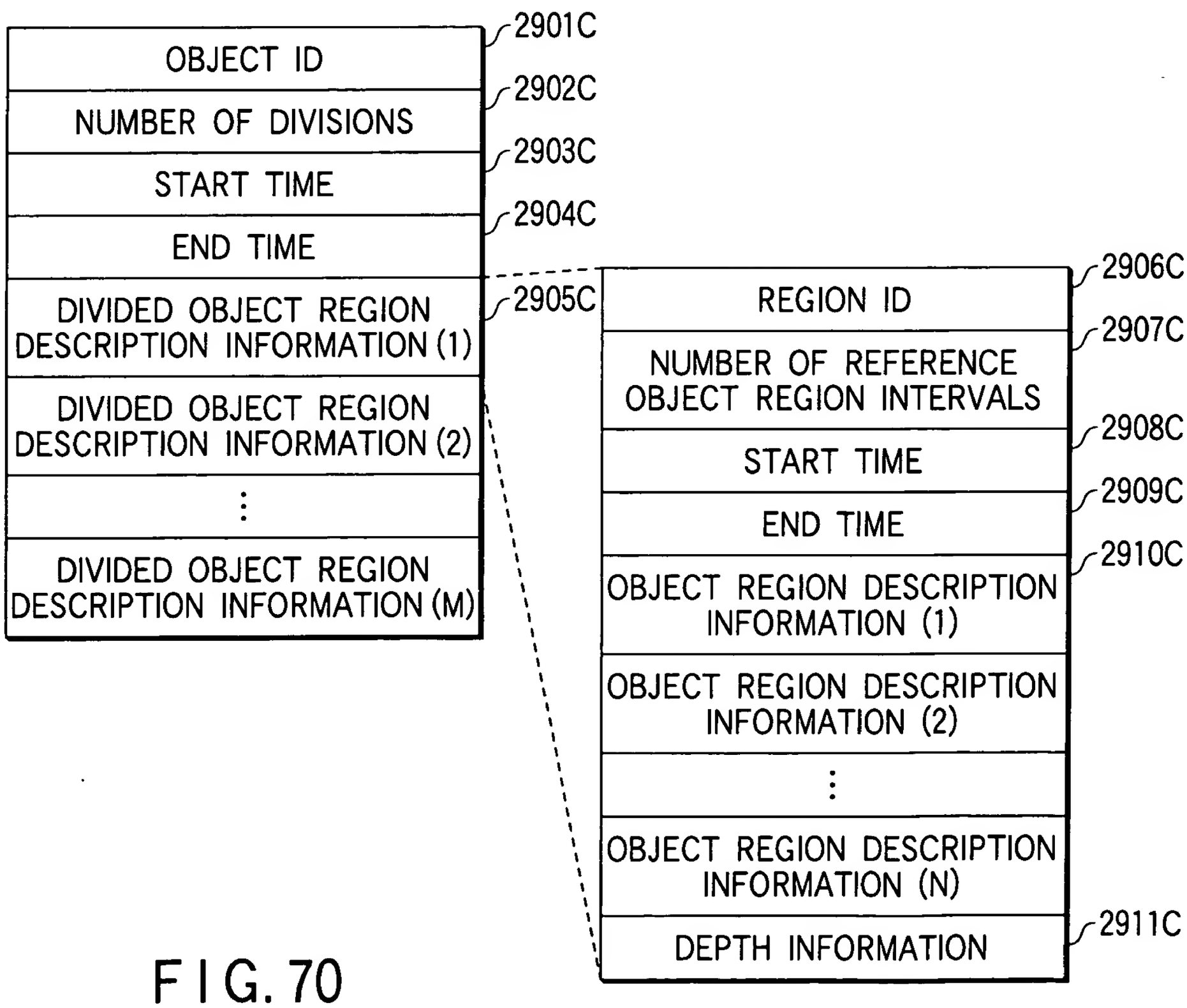

OBJECT ID
NUMBER OF DIVISIONS
START TIME
END TIME
DIVIDED OBJECT REGION DESCRIPTION INFORMATION (1)
DIVIDED OBJECT REGION DESCRIPTION INFORMATION (2)
DIVIDED OBJECT REGION DESCRIPTION INFORMATION (M)
2901C
2902C
2903C
2904C
2905C
REGION ID
NUMBER OF REFERENCE OBJECT REGION INTERVALS
START TIME
END TIME
OBJECT REGION DESCRIPTION INFORMATION (1)
OBJECT REGION DESCRIPTION INFORMATION (2)
OBJECT REGION DESCRIPTION INFORMATION (N)
DEPTH INFORMATION
2906C
2907C
2908C
2909C
2910C
2911C

FIG. 70